DISCOURSE
OF
FERMEN-
TATION.

SIMPSON.

BOUND BY J. LARKINS

cM K
3E
48385/A

£1

SIMPSON, W.

38694

Hodgson
30/3/56
230
5/-

£=1–6

ZYMOLOGIA PHYSICA.

Or a brief

Philoſophical Diſcourſe

OF

FERMENTATION,

From a new Hypotheſis of

Acidum and *Sulphur.*

WHEREBY

The Phœnomena of all natural *Hot-Baths*, the Generation of *Minerals*, the Production of many *Acidulæ* or *Spaw-waters*, the Grand apparances of *Heat*, *Fire*, and *Light*, throughout the triplicity of Natures Dominions, in the productions of Bodies, are ſolv'd from the inteſtine duellings and inward colliſions of the foreſaid principles.

Whereby alſo

Various other ſubterraneal *Phœnomena*, as Damps. Earth-quakes, Eruptions, *&c.* likewiſe the apparances of Meteors, *&c.* and divers other no leſs remarkable then entertaining, are from the ſame Doctrine of Fermentation genuinely ſolv'd.

With an additional Diſcourſe of the *SULPHUR-BATH* at *KNARSBROUGH.*

By W. SIMPSON, *M. D.*

Altiora cogitando nobilitatur mens humana.

LONDON,
Printed by *T. R.* & *N. T.* for *Wm.* Cooper at the *Pelican* in *Little-Britain*, 1675.

1054
1

38694A

WELLCOME
HISTORICAL
MEDICAL
LIBRARY

TO THE
Right Honourable
THE
PRESIDENT & FELLOWS
OF THE
ROYAL SOCIETY.
The following
DISCOURSE
OF
FERMENTATION
Is moſt Humbly
Preſented
BY
THE AUTHOR
W. SIMPSON.

THE PREFACE TO THE READER.

H*E that attempts any thing that is new, whether in* Natural Philoſophy, *or other Sciences, ought with the fam'd* Archimedes, *to beg a ſure footing; and he that builds had no leſs need to lay a good* Foundation, *leaſt in the former he be* driven back, *and in the latter,* the fabrick *by over-hanging, indanger its fall by its own weight. What care I have taken herein, I am now likely to run the* hazard *of thy carping or candid* interpretation, *the common fate to all Books.*

We here preſent to thy view, (Candid Reader, if ſuch thou art) a ſmall Scheme (ſuch as it *is) of the* principles *of* Nature, *which though few, yet probably very* teeming: *We offer here a little* draught *of thoſe pregnant* mechanical *agents,* Nature *(we ſuppoſe) uſeth in the* Formatations *and* Transformations *of all bodies, drawn as near as we can to the life; which at preſent we have compriz'd into this* Epitomiz'd bulk, *leaſt by the ſwelling of its Volume, thou ſhouldſt conjecture its* Title *before thou readeſt its* name. *I have been not a little cautious in the modelling this ſmall* Plat-form, *(though perhaps not without its Chinks and Chaſmes, diſcernable to a curious prying Eye) by which (if it take) a larger draught probably may afterwards be drawn; having endeavoured to calculate this* Phyſiological Scheme, *according to the meridian of an* inquiſitive *ſearching* Age.

When I had well nigh finiſh'd another piece, intituled Lithologia Phyſica; *as alſo another, which bears in its front* Halologia Chymica, *(both writ in Latin) two as conſiderable Subjects (I mean* Petrification *and* Salification *) as I could then pitch upon, both grounded upon a different* Hypotheſis *then was yet extant: before (I ſay) I had compleated the two foreſaid Tracts, it came into my mind, to give a little* compendious account *of a new* Hypotheſis *I had often ruminated upon, which I thought I could not better do, then by undertaking thereby to ſolve ſome of the moſt remarkable and entertaining*

Phœnomena *of* Nature, *ſuch as are natural* Hot. Baths, *the* generation *of* Minerals, *the appearances of* Heat, Fire *and* Light, *&c. which therefore we made the ſubject matter of this enſuing* Diſcourſe: *and do therein ever and anon, refer to what we write in thoſe other mentioned pieces.*

And when I had well nigh finiſhed this ſmall tract, *I began to look about me, and to conſider on which of the* Philoſophers *ſide I was* (*ſeeing they by their various and different* Hypotheſes *are apt,* inſtar Audabatum, *to fight in the dark*) *I could not tell of a good while, till at length I conſidered, that the great* Hypocrates *himſelf has given touches thereof, while in his Book* de Dicta *he tells us,* Conſtituuntur tum omnia animantia, tum homo ipſe ex duobus, igne & aqua: *And that our Doctrine doth coincide with his* contenentia, contenta, & impetum facientia: *The* contenentia *are* vaſa & viſcera: *The* contenta *are* Fluids, *viz.* Water *the* material principle *of* bodies: *The* impetum facientia *are* Ferments, *or* Acidum *and* Sulphur *put into an* inteſtine colliſion *or* Fermentation: *And as he tells us all things are made of* Fire *and* Water; *and that theſe two are ſufficient for all* generations: *ſo he adds, that* Fire *gives* motion, *and* Water nutrition: *which how it agrees with our* Hypotheſis,

Tach. 84.
Jord. 114.
De Dicta lib. 1.

potheſis, *let the enſuing* Diſcourſe *ſpeak for it ſelf.*

So that it appears that Fermentation *in our ſenſe, is the ſame with his* Spiritus impetum faciens *with his* τῶ πυρὸς θείων. *Fire hid in bodies, Its alſo the ſame with that Ætherial matter, the* Panſpermion *of other abſtruce* Philoſophers,*that* divinioris auræ particula *implanted by God* (*the Parent of Nature*) *in* Water; *which from* ſeminal originals, *produce, by a genuine expanſion, all concrete bodies: its likewiſe the ſame which the noble* Helmont *calls* ſemina rerum. *Thoſe indeed* fœcunda ſemina rerum, *which as the Poet goes on,*

> Vivaci nutrita ſolo, ceu matris in alvo,
> creverunt.

And by the more recent Spagirical Phyſiologiſts *its called Spirit, or a combination of* Spirit, Salt, *and* Sulphur: *Its what* Tachenius *intends by his* Acidum pinguæ & filius ſolis, *&c.* Tach. clar. p. 40.

And laſtly, (*to name no more*) *its what in a more plain dialect has been repreſented to us by the Poets from the ancient ſage* Philoſophers, *where one of them ſaith,*

Quippe ubi temperie ſumpſere humorq; colorq;
concipiunt; & ab his oruntur cuncta duobus.

When I had viewed the many high roads and broad tracks (diſtinguiſhed by the firſt tracers, and bore their names) at the firſt ſight each ſeem'd large enough, and promiſed a fair paſſage into the beautiful Garden *of* Nature. *But I found, that as often as I took along them, though I went on pretty merrily at firſt, becauſe the path was well beaten, ſtore had gone that way, yet I had not gone long, ere I perceiv'd ſtill they* ended and ſpent themſelves *into a wide* barren Common, *where I was ever and anon* bewildred, *and at a loſs whither to* turn: *ſo that amidſt ſuch difficulties of* Rocks, Precipices, Hilly-places, *&c. I was glad I got ſafe off: at length I eſpyed a* little narrow way *that had been little beaten, ſo that the* footings *of thoſe who had tract it was* ſcarce diſcernable; *and it lay off from all the reſt of the* broad paths: *ſo that (after I had try'd in vain moſt of the reſt) I took into that, kept in it as well as I could, which was* difficult *to do from its foreſaid* narrowneſs, *and its being unbeaten: and although I now and then* deviated, *yet I found I was not* ſtray'd *ſo* wide, *but that with ſome trouble I got in* again; *and following this path, it led me di-*

rectly into the amiable Garden *of* Nature: *where, what* contemplation *I made, what proſpects I took of thoſe* curioſities *and* rarities *I met with, let this enſuing* diſcourſe *give ſome foretaſts, which as it finds admittance into the World, may give incouragement to publiſh more.*

And here I might take the liberty to aſſure the World, that nothing doth give a man a fairer proſpect *into the inward* receſſes *and* ſecret retirements *of* Nature, *nor doth offer a better view into* Natures Land-skips, *nor doth more open the* Cabbinet *of her choiceſt* rarities, *then that moſt admirable Miſtreſs of Arts and Sciences, the* noble Chymia, *that* clavigera arcanorum naturæ, *which gives admittance into the ſurprizing* Arcana *of* Nature, *whoſe entertaining* Phœnomena *in her genuine* encheireſis, *are ſuch as may ſtrike admiration (not to ſay amazement) in the Artiſt: I mean not here that ſpurious brood of* ſwarming Chymiſts, *thoſe* fumivenduli, *who fill the World full of Smoak and Noiſe, who are but indeed the* blemiſhes *of that noble* Miſtreſs; *the ſpots in that* ſolar Beauty, *the foils that ſet off the* Luſtre *of the* legitimate Sons *of Art, who will ſhine with an* oriental Luſtre *amidſt ſuch empty Clouds.*

He indeed that would be a diligent ſearcher of Nature (*thereby to become uſeful in his* generation) *muſt not diſdain the ſoiling his Fingers with Coals; nor think it below him to* converſe *with the meaneſt of* mechanicks, *but may take time to wipe his Fingers while he is* refining *his* notions, *and rectifying his* contemplations *by remarking the obvious* Phœnomena *of his or others works.*

If this Eſſay *hold good, as its probable in the main it may, it will in great likelyhood be as an* introduction *to further and more clearer* diſcoveries *in the knowledge of the* hidden mechanical agents, *imploy'd by the divine hand in the* fabrick *of all* bodies: *and gives great probability of being an* in-lett *into a better* underſtanding *of the cauſes and efficients of* Diſeaſes, *and their* Cures, *then at the firſt can eaſily be apprehended: and in general may be as a* foundation *towards further improvements in all manner of* Phyſiology *or* Natural Philoſophy.

We would not preſume to ſay, that all other Hypotheſes *ought to truckle (far be it) but ſhall leave the* Peripateticks quadriga *of* Elements, *with their firſt and ſecond qualities, their matter and form,* &c. *The* Epicurean *or* Corpuſcularian *Doctrine, founded upon Matter, Figure, and Motion, the Figures depending upon thoſe of round, quadrate, acute, cylindrical ſtriate,* &c. *of Atoms, making a pleaſant* Methematical Scheme, *adorn'd by the curious notions of* Carteſius *and others: The* quinary *of the late* Spagyriſts, *The* ternary *of the* Chymiſts (*although that in a genuine acceptation is the moſt* *plauſible)* *The* Binary *of the* Tachenians, *&c. But ſhall I ſay, leave each of the foreſaid to the judicious, to compare with this, and to judge of according to their worth and intrinſick value.*

And onely ſhall refer to the computation of the unbyaſs'd Reader, *whether an* ingenious perſon *may not be* inabled *to take a further* proſpect *into the* nature *of* things, *and be capable of making better* inſpections *into the* inſides thereof, *and of taking larger meaſures towards a further and future* improvement, *then from any other* yet extant: *where, although I ſhould be found wandering, yet would not (Candid Reader) deſpair of thy* favourable aſpect, *and that upon the very foreſaid reaſons,* viz. *both of the* uncothneſs *and* untractedneſs *of the* path, *having neither guid nor leader, yea ſcarce any* Land-marks, *but what was ſet up by the induſtrious labours of the* Spagyrical Science, *whoſe* ne plus ultra Pillars *are beyond our hopes of ever reaching.*

I would here once for all ſay, that I onely propound my Hypotheſis *as a modeſt* Eſſay *towards the further* improvement *of that noble Doctrine of* Fermentation: *For not being ſatisfied with any thing I have yet ſeen extant upon that Subject, has given me* occaſion *to ſearch further into the* nature *and* cauſes *thereof: not being content with a bare* ipſe dixit, *or to ſit down under the* dogmatical placets *of* Authors, *at the foot of*

ſuch

uch Gamaliels, *gave my ſelf ſcope to trace* nature (*if I could*) *in her more* hidden paths *and* ſecret tracts.

And indeed the onely right way of eſtabliſhing *any ſort of* Hypotheſis, *is firſt to procure a ſett of* paralel experiments, *and to be* furniſhed *with a competent ſtock of* mechanical Trials, *which are ſo well to be contriv'd, as to accord amongſt themſelves in their moſt* remarkable appearances; *and this is to be obſerv'd in the* erecting *any* Hypotheſis, *whether* Phyſicks, Medicks, *or any* material branch *of either, as the true* baſis *to build upon, conſulting in the one the* experiments, *in the other, the* obſervations *of* ingenious perſons, *in order to the raiſing ſuch a* ſtructure *as will not eaſily fall, and of confirming ſuch a* Theory *as will abide the teſt of after ages.*

Now how ours of Fermentation *ſquare herewith, I muſt appeal to the* judicious Reader; *For after we had laid a great many of* experiments together, *and had found where, in their moſt* obſervable Phœnomena *they hit and concentred; by an induction I ſay of which particular* experiments, *conſpiring in the reaſons and cauſes of their* main ſolutions, *we began to propoſe to our ſelves an* Hypotheſis *which might beſt ſuit therewith, and moſt genuinely reſult therefrom, and found from its* congenialneſs *to the* principles *of* Nature, *not onely to hold good in thoſe which at firſt fell under our* conſideration, *but alſo in others which afterwards* occurr'd *to our* thoughts, *and that from the* conſonancy *and* conſiſtency *of* Nature *to her ſelf in all her actions, both in the* geneſis *and* analyſis *of bodies.*

And now, kind Reader, (that I may conclude) thou haſt viewed the front, *and paſs'd the* Portal, *if thou has taken any pleaſure therein, and art at leiſure, my advice is, that thou forthwith enter, and I would lead thee by the hand into the* building *it* ſelf; *conſider the* materials, *look at the* foundation, *pry (though not too narrowly) into the* cement, *paſs through every* Room, *obſerve the* proportion *and* ſymmetry *of the parts; and if thou canſt not otherwiſe come to a* reſolve *in thy* judgment, *yet at leaſt gueſs at the deſign from the* contrivance *of the plot: if thou ſay it wants* finiſhing work, *we confeſs it, by acknowledging it to be the firſt, and therefore more rude draught: if thou ſay our* Lights *are too much* ſhaded, *we ſay ſo too, owning our weakneſs in that Art; if, that our* Fires *which ſhould warm, dry, and do other offices to the Natives, are too much* clouded *with* fumes, *we will not contend: onely beg of thee, by putting things into a* juſt ballance, *to weigh them well before thou paſs thy* ſevereſt judgment, *and thou wilt* oblige *him to concern himſelf* further *in the like* matters, *who remains Thine*

W. S.

BIBLIOPOLA LECTORI.

Gentle Reader,

THe Authors more earneſt occaſions not permitting him time to wait upon the Preſs, hath occaſioned ſome literal miſtakes; and although ſmall ones, yet will not the exact curioſity of the Author paſs them by, but that I muſt lay them open to thy view, and crave thy Correction. But more eſpecially I beg yours and the Authors excuſe for a more conſiderable miſtake by me committed, in returning to the Printer a wrong Paragraph in page 11. *an attonement for which I have endeavoured to make, by giving you the corrected one, which you will find Printed at the end of this diſcourſe.*

VALE.

PAge 17. l. 13. minglable, p. 30. l. 2. *viride æris*, l. 7. incorporated, p. 37. l. 21. hewing, p. 42. l. 10. cork'd, p. 44. l. 28. patent, p. 51. l. 7. bilious, p. 36. l. 17. are pleuriſies, l. 28. before gentle *add* ſeaſonable, p. 61. l. 27. maternal, p. 62. l. 1. invigorating, l 25. tnrns, p. 63. l. 3. duellings, l. 5. *vitali*, l. 17. *leſſas*, p 69. l. 24. temper'd, p. 71. l. 13. of r. upon, l. 23. barm, p. 72. l. 17. Rye, l. 22. your r. yea, p. 73. l. 20. their r. the, p. 74. l. 29. fat r. fall, and florid r, ſoft, p. 76. l. 20. maturations, l. 24. neutral, p. 77. l. 1. there r. thereof, p. 79. l. 15. wood. r. woad, p. 80. l. 2. Urinous, p. 85. l. 21. with r- which, p. 87. l. 17. Tabes, p. 88. l. 4. dele *world*, l. 28. cloſing, p. 98. l. 4. after cloſing *add* with, p. 105. l. 6. intence'd dele *d*. p. 113. l. 7. ſpring r. ſyringe, p. 118. l. 5. intromiſſion, p. 121. l. 12. breath'd, p. 123. l. 18. *globuli*, p. 139. l. 24. dyſcraſie, p. 142. l. 6. tinge. Sulphur-Bath, p. 25. l. 11. ſolvent.

A
Philoſophical Diſcourſe
OF
FERMENTATION.

CHAP. I.

WE ſhall not here ravel into the opinion of others concerning this great doctrine of *Fermentation*, which whether we look upon in a more large ſence, as the very *Baſis* of *Natures* workings in the formations and transformations of *Bodies*, or in a more ſtrict, limiting it (as ſome Authors do) to the bare confinements of ſome animal and vegitable juices: If the former, it might come in competition with all other ſorts of Principles, laid down in the various kinds of Hypotheſes by divers *Phyſiologiſts*, whether *Peripateticks*, *Epicureans*, *Carteſians*, (which is but the latter poliſht) *Paracelſians*, *Helmontions*, *Willeſians*, *Tachenians*, &c. and ſo might require a larger diſcourſe then here we intend: If the latter, we ſtint and ſtraiten *Nature* in her more ample work of generations,

making

making her ſquare to our ſtrait-lac'd and byaſſed notions: We ſhall in neither ſence, I ſay, take an occaſion to examine the Opinions and Judgments of others, referring that task to another place. But ſhall without any unneceſſary Prologue fall to our intended work.

Only we would premiſe, that whereas the *Corpuſcularians* (who are now the moſt recent *Phyſiologiſts*) ſuppoſe matter under the conſideration of *motion* and *figure*, to be the competent Elements and Principles of *Bodies*, we ſhall anon ſhew, that by the power of *Fermentation*, one part of matter *mechanically* indiviſible, may for ought we know be ſplitt and ſub-divided by a ſubtile comminution into 1000. perhaps 10000 parts: now whatſoever *figure* theſe (not almoſt but altogether) unimaginable minute parts have or may be ſuppoſed to have, yet can ſignifie nothing in the *fabrick* of *Bodies*, till they jump together again or coincide into a ſtricter compage: So that ſuch parcels of matter as come neareſt to a *mechanical diviſion*, or at leaſt come neareſt to be perceptable to the acuteſt Organs of our Senſe, fortified by *artificial contrivances*, are ſuch as we ought chiefly to look after, and to conſider as principles in order to the *geneſis* and *analyſis* of *Bodies*.

Nor are we to look at the *Elements* of *Bodies* as confin'd to ſuch narrow limits, that thence of neceſſity they ſhould be pent and thruſt up into indiviſible figur'd points: So that matter under the notion of figure, as of round, ſquare, cubes, *&c.* in Phyſically indiviſible points, cannot truly and in a genuine *Phyſiological ſence*, be reputed the Elements of bodies: For the reaſon, ſuppoſe, of extenſion of matter in the concretion of Bodies, conſiſts, (we conjecture) chiefly, if not ſolely, *in a coagulating texture of plyable parts of matter*, wrought up before while in *Succo Soluto*, by *Fermentation*: and not only extenſion but diviſibility of matter previous to extenſion in the production of *concretes*, we aſcribe to the ſame cauſe: ſo that whatever the *Corpuſcularians*, attribute to *motion*, *diviſibility*, and *figure* or *ſize* of *particles* of *matter* in order to make up the Elements of Bodies, we ſee no other cauſe but to aſcribe to matter, *viz.* (*water or watery particles*) ſet into a Fermentative motion, which without any more ado, performs the whole buſineſs, as we ſhall in the ſequel of this diſcourſe illuſtrate, this being premis'd.

The Method we intend to inſiſt upon and to trace in order to the right underſtanding, and towards proſecuting the due improvements of the doctrine of *Fermentation*, according to our *Hypotheſis*, will be firſt to explain what we mean by *Fermentation*, giving as conciſe a definition as the nature thereof will admit; next, to ſignifie of what large extent it is in the whole round of *Natures* workings, which will be elucidated by an induction of particulars, *viz.* how the *Phænomena* of *hot Baths*, the *production* of *Minerals*, the *origin* of ſome *Acidulæ*, or *Spaw waters*, the grand apparances of Heat, Fire, and Light, throughout all *Concretes*, whether in the familie of *Minerals*, *Animals*, or *Vegitables*; alſo how many other ſorts of *Phænomena*, obvious in the large field of *Nature*, may without ſtraining be ſolv'd from the true principles thereof, conſonant to *Nature* in all her workings.

In the handling of the firſt, we may take leave to ſay, That *Fermentation* in the true genuine ſence thereof, is nothing elſe, but an *inteſtine Colliſion* or *mutual wreſtling* betwixt *Acidum* and *Sulphur*, put together by *Nature*, (or by *Art* in imitation of *Nature*) and ſet in a combating motion, in order to the production of ſome *Concrete*, or to ſome other equivalent end, whereby, if not interrupted, in liquid juices, heterogenities are ſeparated: whoſe firſt on-ſets are ſometimes, eſpecially in the *Embrio-ſtate* of ſome things, ſlow and indecernable motions, whilſt in other Stades they paſs through, they arrive at more brisk frettings, and yet heightened, may ſometimes ariſe to actual *flagration*, as we ſhall ſhew afterward: And that *nature* (as we ſhall anon ſhew) uſeth theſe two as the grand *mechanical principles* in the productions of all *concretes*, whether *mineral*, *animal*, or *vegitable*, and that too not onely in their *concretions*, but *reductions*, in their *geneſis*, but *analyſis evolutions* and *revolutions* , *weavings* and *unweavings*, *windings* on and off in all Bodies.

Only, Firſt with this difference in the threefold *Kingdom* of *Nature*, that tho the *acids* of *vegitables* be different from thoſe of *animals*, and both from thoſe of *minerals*, retaining a *ſpecifical* difference amongſt themſelves, whereby they conſtantly keep up the *badge* of their *diſtinction* in their ſeveral *Claſſes*, yet all are in a true (and not metaphorical) ſence, *acids*, the like may be ſaid of their *Sulphurs*, which are truly (and not analogically) *Sulphurs*.

And Secondly, with this difference amongſt the ſame *Acids* and *Sulphurs*, as they are conſidered under the notion of the *geneſis* and production of *Bodies*, from what the ſame are in the right underſtanding of the *analyſis*, reductions and unweavings of *Concretes*. So that *nature* hereby is every where uniform to her ſelf, and that too from the *conſonancy* and *harmony* of her *principles* : We ſay therefore and ſhall prove in the ſeries of our following diſcourſe, that there are no *concretions of Bodies*, as they aſſume their birth from the legitimate broodings of *nature* in all *ſeeds* and *ſeminal* offſprings, without the concurring efficients and principles of *Fermentation*, which as they are hid and cloſe ſhut up in the very *primordial ſeedlings* of things, and are known to us only *a poſteriori* (inaſmuch as they are indiſcernable *a priori*, but by an intuitive knowledge) yet *ex ungue leonem*, we may eaſily take their meaſures from thoſe Scantlings we can trace in their footings.

Now for the better rendring our Doctrine of *Fermentation* intelligible, *viz.* how *nature* by the foreſaid *principles* ſet to work in the very *primordials of things*, goes on (if not interrupted) in a *linear proceſs* towards the *productions* thereof, we ſhall begin with the *mineral Kingdom* : where we ſhall illuſtrate the veracity of our *principles* of *Fermentation*, by thence ſolving the *Phenomena* of *hot Baths*, the productions of *minerals*, and other *ſubterraneal apparances*, as they will in courſe fall in our way.

In order to the right underſtanding of *hot Baths*, and to demonſtrate they have their *original* from *Fermentation* of *mineral juices*, our method will be to lay down *two poſitions*, the firſt whereof is, that there is no *hot Bath* without *Sulphur.* The Second, That an *Acid* is neceſſarily requiſite in all *mineral Fermentations*; and that all *Acids* ſo concern'd, are either native or ſuper-induc'd, alſo to ſhew what we mean by *Sulphur*, and how *hot Baths* differ chiefly according to the difference of their *Sulphurs* : And which amongſt them are not *ſafely* to be taken *inwardly* and which *are:* Then to ſhew how from the foreſaid *principles* put together into an inteſtine *colliſion* and *Fermentation*, the waters that paſs through them, muſt neceſſarily become *hot*, and this is then to be confirm'd by an induction of *mechanical Experiments*, alſo to ſhew how *Sulphur* by *Fermentation*, becomes *comminuted volatiz'd*, and capable of *Solution* in *Water*, as happens in all *hot Baths*, and to ſignifie a paralel betwixt *mineral* and *vegitable Fermentations*, &c.

CHAP. II.

As to the truth of the firſt *poſition*, *viz:* that there is no *hot Bath* without *Sulphur*, appears, becauſe as there is no *heat* without *Fermentation* of *mineral juices* (I mean as to *ſubterraneals*) as we ſhall make evident afterwards, ſo no *Fermentation* without *Sulphur*; For although indeed from mixtures of *Acids* and *Alcalies*, (whether fixt or volatile) *Fermentation* and *Heat* doth neceſſarily reſult: yet becauſe they are artificially produced; and next, becauſe it will be difficult to find out the ſources of theſe *heats*, and the true genuine *cauſes* of ſuch *Fermentations*, from the *variety* of thoſe *efficients*, I mean *alcalies:* for notwithſtanding there be plenty of *alcalizate* *alcalies*, (as I may call them to diſtinguiſh from *lixivial*) wrapt up in the texture of *Petrifick concretions*, yet there muſt be ſtore of very *Corroſive acids*, that can be ſufficient to cauſe ſo great a *Fermentation*, which we may never expect to find: Therefore *Tachenius* his *Hypotheſis* of *acids* and *alcalies*, will not do our work, as being too narrow in the *foundation* to raiſe ſo large a *ſtructure* of *Philoſophy* upon, as genuinely to ſolve the various *Phœnomena* of *nature*, and particularly in this apparance of *hot Baths*, as anon will be more evident.

By *Sulphur* I do not confine my ſelf in my *Hypotheſis* to that particular *mineral Concrete* call'd *Sulphur* or *Brimſtone*, which although that be a Subject in whoſe concretion more plenty of that matter I call *Sulphur* is interwoven, or rather coagulated, then in any other: yet by that term, I do not only mean what is *flammable* in that body; but alſo the like *anologous flagrable* matter in other *minerals* or *metals*, as to *minerals* whether in *Antimony*, *native Cinnaber*, *Arſneck*, *Auripigmentum*, *Marcaſites*, *Pyrites*, *Succinum*, *Gagates Lythanthrax*, &c. As to *metals* in *Lead*, *Tin*, *Iron*, *Copper*, and *Quick-ſilver*, or in both, *viz. Vitriols*, which are *metals*, eſpecially *Mars* and *Venus* reduced into that form by the help of *mineral acids*; I ſay I do not only mean what is *flagrable* in the foreſaid *Bodies*, or may be ſeparated in a *combuſtable matter*: But alſo I include all *bitumen* and *unctuous matter*; whether repoſed in *Earth*, *Stones*, or the like: As to which *Sulphurs*, even in all *combuſtible Concretes*, we know not that ever they appear ſincere, but always more or leſs complicated with their *connate acids*, and upon every ſort of *Fermentation*, (as we ſhall ſhew more afterwards) whether in the ſlow or quick, low or high degrees thereof in *vegitation*, *animation*, *mineralization*, *ignition* and *flagration*, they continually wind off, and do *tenues evaneſcere in auras*.

And alſo in the fore ſaid *Bodies* wherein *Sulphur* predominates, or is ſeparable, an *acidum* is plainly diſcoverable to be the *inmate* or *companion* thereof, as is obvious by the burning of *Brimſtone*, the *Sulphur* of *Antimony*, &c. which by condencing the fumes, give an *acid Spirit* (which whether all combuſtible matters amongſt *animals*, *vegitables*, and *minerals*, will yeild peculiar ſorts of *acids*, I may elſewhere treat) yet becauſe the *Sulphurous principle* hath the preheminence in ſuch concretions or unctuous Liquors, we ſhall therefore diſcourſe of them under the notion of *Sulphur*.

Now to prove that *Sulphur*, either crude or volatile, is found in moſt, if not all known *hot Baths*, let us conſult what *Authors* ſay herein: who have ſeen and made obſervations upon them.

Thus in the *aqua Aponenſi* that fam'd *hot Bath* near *Padua*, ſo much diſcours'd by *Fallopius*,

pius, *certo collegi* (ſaith he) *&c. vaporem Sulphureum in illa aqua Aponenſi contineri*, and ſaith further, *eſt aqua ferventiſſima, & dum calida eſt ſapit Sulphur & Bitumen, &c.* The learned Dr. *Ed. Browne* fellow of the *Royall Society* in his *Travels* tells us his obſervations:
‘*Sulphur* (ſaith he) which is in great quantities
‘in many *hot Springs*, flyeth away continually,
‘and is not to be found in them, if
‘you boyle or evaparate the *Bath-water*: and
‘therefore to diſcover it, I thought it more
‘rational to look out of the water, then into
‘it; for upon many places which were over
‘the *Baths*, and received the Steams of the
‘*hot water*, I have ſeen *Sulphur* ſtick: And to
‘ſatisfie my curioſity further herein, I cauſed
‘once a Pipe to be opened at *Baden in Auſtria*,
‘through which the *hot water* continually ran,
‘and took with my hand from the upper part
‘of the Pipe, divers Boxes full of a ſubſtance
‘ſcarce to be diſtinguiſhed from *Flower* of
‘*Brimſtone*.

Thus we ſee how *Sulphur* diſſolv'd in theſe *Baths* doth ſometimes precipitate along the ſides of the Channells through which it runs; as alſo being *volatiz'd* doth paſs away (I mean the purer part) in *vapors* or *ſteams* inſenſibly, till arreſted by ſome particular bodies, it ſettles and ſticks thereto: Thus the foreſaid *Author* obſerved, ‘That walking about one day in
‘the *lower Bath* at *Baden*, and leaning over the
‘balli-

'Balliſters, perceived that his Buttons, and 'what elſe he wore that was *Silver*, were all 'turned yellow of a fair *Gold* colour, although 'he was at ſome diſtance from the *Water*: 'whereupon he tryed this *Experiment*, viz. of 'hanging money over the *Bath* at a foot di'ſtance, or at a greater, and found it coloured 'in a minutes time, and that which was nearer, 'in half a minute.

Next we are to conſider how theſe *Thermæ* or *hot Baths* differ amongſt themſelves (which as we conceive) chiefly proceeds from the difference and great variety of *Sulphurs* or *Mineral Bodies*, wherein are wrapt up a diverſity of *Sulphurs*, through which they paſs, and with which they are impregnated, together with ſome other *mineral parts* which they take in, either at the place of *Fermentation*, or afterwards in their *paſſage*. For *Sulphurs* (which we ſuppoſe to be chiefly concerned in all *mineral Fermentations* differ much amongſt themſelves, *common Brimſtone* being different from that of *Antimony*, and that from the *Sulphur* of *Vitriol*, *Pyrites*, and other *mineral Marcaſites*, all which are yet different from *Arſenical Sulphurs*, and from *bituminous matters*, one ſort or other of which are moſt what the predominant ingredient and *mineral principle* of theſe *hot Baths*.

Hence it is that ſome of theſe *Sulphurous waters*, may with good ſucceſs in order to the cure of ſome diſeaſes, be taken *inwardly*, others not, Thoſe that may not, are generally ſuch whoſe *Sulphurs* are *Antimonial*, *Arſenical* or *Bituminous*, or at leaſt border upon ſuch *minerals* as are allyed thereto; of which are the generality of *hot Baths*, and in particular thoſe of our own Nation, of which the *Sommerſet-ſhire* being the hotteſt, are found altogether unfit for inward uſes, are not *ſafely* to be *drunk*, inaſmuch as they are impregnated (as I conceive) with *antimonial*, or perhaps *bituminous Sulphur*, or the *Sulphur* of ſome *Pyrites* or other *Marcaſite*, a kin to *Antimony* or *Bitumen*, which lodgeth in the bowels of thoſe great *Mountains*, at the Foot or Center of which thoſe *hot Baths* break forth: for the *acid* which concurs neceſſarily (*as* we ſhall ſhew afterwards) to thoſe *Fermentations*, as an indiſpenſible principle, opens the body of thoſe *Sulphurs*, or detains them whilſt *in fieri* in their *crude nature*, and thereby renders them wholly noxious for inward uſe, as we could further illuſtrate, but that we haſt.

Nor is *Buxton Bath* in *Darby-ſhire* (from the ſame cauſe, although in a remiſs degree) fit for taking *inwardly*: inaſmuch as that according to all probability, partakes of a *bituminous Sulphur*, and that I gather from the plenty of a *bituminous* or oylie ſubſtance, got out of the very Clefts of the Stones in the *Peake*, yea this *bituminous* or oylie matter is found in the very Pores, Clefts and *Cavites* of the *Stones* themſelves, as was communicated to me from the judicious, and my worthy Friend Mr. *Joſſop*, whoſe Father (as he acquainted me) got two Spoonfuls out of one crevice in a Stone, which *bituminous matter* is lodg'd not only in thoſe *ſtones*, but alſo in a ſort of light *lithanthrax*: which rub'd (being a ſmooth polite body) is *Electrical* (as I have found by trial) which diſtilled, yields an *oyle* and *acid spirit*, almoſt like that of *Amber*, as the ingenious Mr. *Fiſher* inform'd me he found by trial, yea the ſame *bitumen* is imbib'd into a *fungus matter*, which Dr. *Liſter* ſuppoſeth (and that very likely) to be rotten wood long buried in the earth, into which this oylie matter or *bitumen* hath ſunk, which keeps (as I have found) continually moiſt, tho kept in a dry place. I ſay, its very probable that the *Sulphurous principle* of *Buxton Bath*, hath its determination from this ſort of *bitumen*; And as to thoſe Sulphurous waters which may ſafely be taken inwardly, are chiefly the *Sulphur-well* at *Knarsbrough*, of which we ſhall further diſcourſe in a Chapter by it ſelf afterwards.

And as to the different degrees of heat in *Baths*, may proceed either from the more remiſs or intenſe *Fermentation* of *mineral juices*, or from the different place of *Fermentation*, as it may be deep within the *bowels* of the *Earth*, or near the place of its *Exit*, thus if the *Fermentation* happen to be far within the Earth, and ſo remote from the place of Erruption, that the *Sulphur* thence become much what *precipitated*, or left in the *colander* or filter of Sand, through which it paſſeth, and the *acidum* thereby ſo dinted as to become very *languid* (if at all perceptable) in the Water, and yet by reaſon of its cloſeneſs from the air, may retain ſomewhat of its firſt conceived warmth, of which ſort are thoſe *Sulphur Baths* near *Villock* in *Carinthia*, which are gently warm, (as the learned Dr. *Browne* notes in his book of *Travels*) as alſo as I ſuppoſe, *Buxton Bath* in *Darby-ſhire*, whilſt in other parts of the earth, the foreſaid *Fermentation* may be ſtrong both from the plenty of the two combating *principles*, as alſo from their nearneſs to the place of breaking forth, of which ſort are thoſe at *Glaſs-Hitten*, *Eiſenbacke*, both not far from *Schemnitz* in *Hungary* (where are *ſilver mines*) alſo thoſe of *Stubn* near *Newſol* in the ſame Countrey, thoſe at *Baden* in *Auſtria*, and eſpecially ours at the *Bath* in *Sommerſet-ſhire*.

We ſay alſo, that *Fermentation* of *mineral juices* is moſt neceſſarily requiſite to the producing of all *hot Baths*, and conſequently all *hot Baths* depend thereon, becauſe hereby is made a *comminution* of Sulphurous, or other *bituminous juices*, which thence become communicable to, and diſſolvable in ordinary *ſpring-water*, for hereby the *Sulphur* is ſever'd into volatile parts, eaſily *permeating* the body of *water*. The paralel of what is produced by *Fermentation* in *vegitables* to what is performed by the ſame amongſt *mineral juices* in order to the making *hot Baths*, is not inconſiderable, whether we look at the *agents*, or at *Fermentation* its ſelf, or laſtly at the effects, as to the agents, which here are requiſite to perform *mineral Fermentations*, we ſhall demonſtrate afterwards to be no other, then *mineral acids* and *mineral Sulphurs intoris mineralibus*: That alſo *Acids* and *Sulphurs* (to wit of their own kind) are the true *agents* in the performing all *vegitable Fermentations*, we may elſewhere *ex inſtituto* diſcourſe: as to *Fermentation* it ſelf, which whether in *minerals* or *vegitables*, is nothing elſe but an inteſtine *motion* of the eſſential conſtituent principles of *Acidum* and *Sulphur*, which is in a more remiſs or intenſe degree, and the heat conſequently more or leſs, according to the ſlower or more brisk on-ſets and inward *ſtruglings* of thoſe *combitant principles*; Laſtly, the paralel will hold good in the effects of *Fermentation*. Thus as the effects of the ſenſible *Fermentation* in all *vegitable* Fermentative Liquors is the *comminution* and *volatization* of their *Sulphurs*, as that what before ſuch ſenſible *Fermentation* was *ſeparable* in the *form* of an *Oyle* by bare infuſions and diſtillations in ordinary *water*, is now by the *comminution* of previous *Fermentation*, ſo divided, ſub-divided, and volatiz'd, as that theſe *vegitable Sulphurs* will not only ariſe by the gentleſt heat, but will alſo eaſily diſſolve in any *water* or common *vehicle*; As we plainly ſee that any *vinous Spirit* made from vegitables by *Fermentation*, will eaſily mix with ordinary *water*: which the *oyles* of thoſe *vegitables* ſeparated before *Fermentation* would not do; So likewiſe the effects of thoſe ſenſible (at leaſt by their heat) *Fermentations* in *mineral* Fermentative *juices*, is no other then the *comminution* and *volatization* of their otherwiſe *crude Sulphurs*, For what is it (would I ask) that can render *Sulphur* and bituminous *juices* capable of incorporating with *Spring-water*? Seeing that neither fire (which what that is in a true *Phyſiological* ſenſe according to our *Hypotheſis*, we may elſewhere declare) in the vulgar notion thereof, nor *Salts* (I mean *fixed* or *volatile*) can alone perform that work, For by fire if in open Veſſels, *Brimſtone* being burnt, it ariſeth with a fume condenſible into an *acid* Sulphurous Liquor, witneſs the oyle of *Sulphur per Campanam*, made by *flagration*, and in cloſe Veſſels, it makes no alteration, ariſing only in *Flowers*, which are nothing elſe but the entire body of *Brimſton*, unaltered or opened: and as to *fixt* vegitable *Salts*, thoſe indeed open the body of Common *Sulphur*, or Sulphur of any of the *minerals*,

rals, ſo as to make them more capable of diſſolving in thoſe *congenial menſtrua's* of Oyle, or *vinous Spirits*, but do not at all procure their ſolution in common water, for *water* being poured to any of the foreſaid ſolutions of *Sulphur*, made either with Oyles or *vinous Spirits* by fixt *Salts*, do forthwith *lacteſcere*, cauſing a precipitation of the very body of *Sulphur* in a milkie form call'd *lac Sulphuris* ; So that it remains that nothing elſe ſhort of *acid juices*, can perform this great work of *diſſolving* mineral *Sulphurs*, ſo as to make them mingable with water ; which is performed one of theſe three ways, *viz.* either by bare *ſolution*, *diſtillation*, or *Fermentation* ; in all which the *acidum* muſt have the preheminence before ſuch ſort of alteration upon *Sulphur* can be made ; thus as it is *ex intuitu Sulphuris*, that all *metals* are diſſolvable in the *Stigian* or other proper *menſtrua*, which being taken in pieces by *acids* (together with their *congenial Sulphurs*) the *mercurial* and other parts complicated in the texture of that body, doth *colliqueſcere* : So likewiſe it is *ex intuitu acidorum* that all *mineral Sulphurs*., or Sulphurous Concretes, do either diſſolve in water, or are capable of *diſtillation* into Liquors ; or laſtly, do undergo *Fermentation* and the products thereof.

Firſt, As to *ſolution* in water thus *vitriol* or *vitriolin marcaſites*, which contain plenty of *Sulphur* do either *per ſe*, or expos'd to the air, become capable of *diſſolving* moſt what in *water*, and that from the prevalency of their *acids* above their *Sulphurous principle*, whereby the *Sulphur* lurks under the mask of the *acid*.

Secondly, As to their *diſtillation*, I mean of *Sulphurs* in the form of *Liquors*, that happens alſo from the powerfulneſs of their *acids* aſſiſted by the *acidum* of fire, us'd in ſuch *diſtillations*, whereby the *Acidum* and *Sulphur* do *colliqueſcere* into a *corroſive Liquor*, as appears in Oyle of *Vitriol*.

And Laſtly, This *Acido-Sulphurous-Liquor*, (and others of the like nature prepared as aforeſaid, by *diſtillation*) if diluted by the addition of a little *water*, or of any oylie Liquor, or *vinous Spirit* be mixed therewith, the *Sulphur* is preſently ſet upon by the *acid*, from whoſe mutual *aſſaults* ariſeth a ſtrong *Fermentation*, making the Glaſs intenſely *hot*, and thereby ſometimes comes near to an actual *flagration*: So that it is the *acidum* variouſly treating the *Sulphur*, whence all theſe varieties of operations proceed; And by this laſt work of *Fermentation*, the *Sulphur* is more *comminuted*, *volatiz'd*, and altered, then by either of the two former. Its true indeed, that *fixt alcalies*, or *Calx vive* (being analogous to the former) doth ſo work upon the body of common *Sulphur*, or Sulphur ~~of ſome~~ *minerals*, and thereby opens it, ſo as meeting with an *acid juice*, may make a reſemblance of ſome *Sulphur waters*, as we have elſewhere largely diſcourſt in our *Hydrologia Chymica*, concerning the *Sulphur-well* at *Knarsbrough*, which is without doubt, I mean the *precipitation* by the *ſupervening acid*, the cauſe of the ſtrong ſmell of this and ſome other the like waters.

Amongſt the cauſes aſſigned by divers *Authors* of the heat in *natural Baths*, thoſe of *ſubterraneal fires* are not the leaſt, which becauſe we have by ſufficient arguments at large exploded in our *Hydrologia Chymica* , ſhall now therefore wave : But the great and moſt authentick opinion is that of Dr. *Jordens* in his book of *natural Baths*, which by many learned perſons, hath (and that not unworthily) the kind acceptance, and the moſt general applauſe which is grounded upon a *Fermentation* from a *ſeminary* Spirit of *minerals*, in the bowels of the earth, meeting with convenient matter, from which Spirit acting upon the matter in *generation* of *minerals*, is cauſed that *heat* which perpetuates *hot Baths*.

It would be too tedious a task, for this intended ſhort tract, now to wade into a deep examination of the *Hypotheſis* of this learned man, I ſhall only ſay (leaving the reſt of that doctrine in its own worth) that had that judicious perſon been better acquainted with the underſtanding of the true and genuine ſenſe of *Fermentation*, would no doubt have poliſh'd his notions much better then we find them, and would have told us wherever *Fermentation* was found (in whichſoever of the triplicity of *natures* Kingdoms) that there neceſſarily muſt concur the *principles* of *Fermentation*; and that *Sulphur* or Bituminous matter (being a kin to *Sulphur*) muſt be one of thoſe principles, as to the *mineral Kingdom*, and conſequently be an indiſpenſible ingredient in all *hot Baths*: For *Fermentation* can no more *exiſt* without its own *principles*, then *fire* can without *combuſtible matter* (or the principles of firing) nor then *animal* bodies can be ſuſtained without their peculiar *Ferments*, which what analogy theſe, *viz. vegitable* and *animal juices* in their *Fermentations*, as to their conſtituent *principles* bear to thoſe of *minerals*, we may elſewhere give an account.

Onely here we ſhall take occaſion to anſwer that grand objection the foreſaid ingenuous *Author* makes againſt *Sulphur*, being the cauſe of *heat* in *Baths*: For though we do not aſſert, that *Sulphur* ſingly conſidered, is the cauſe of *Fermentation* or *Heat*, but that it is one of the *principles* of *Fermentation*: yet we judge that objection toucheth upon the Verge of our *Hypotheſis*, and therefore worthy our ſolution: The Objection is, That if *Sulphur* can give *actual heat* to our *Baths*, it muſt *burn*; the like he ſaith of *bitumen*, that unleſs it be kindled, it can yeild no heat to our *Baths*.

I anſwer, That hereby it is obvious, that the foreſaid *Author* did not throughly underſtand the true *efficients* of *Fermentation* in *mineral juices*; for if he had, the queſtion had been beyond diſpute; for though *Sulphur* or common Brimſtone in its *concrete ſubſtance*, is not the Sulphurous principle *nature* uſeth in the producing of *Fermentation* in the primary *diſſeminate juices*, where ſuch things are *in Embrio*, or in *ſolutis principijs*; yet even that very concrete body, whether in the form of *Brimſtone*, or complicated within the texture of other *minerals*, *Pyrites*, &c. is by the ſupervening of a powerful *acidum*, capable of *Fermentation*, and thence of imparting its more ſubtile *apporrhea* or *ſteame* (by the comminution of the foreſaid *Fermentation*) and ſuſceptable of the virtues thereof: So that it appears, that *Sulphur* may be one of the efficients of *heat* in *Baths*; and yet its *flagration* not requiſite at all: the ſame we may ſafely ſay of *Bitumen*.

Now as we have endeavoured to prove *Sulphur* whether *in ſucco ſoluto* in the very primordial ſhapings or generations of *minerals*, or the ſame reduced from mineral concretions by the ſuperinduction of *congenial acids*, to be one of the two ingredients or mechanical Organs *nature* uſeth in mineral *Fermentations*: This therefore leads me to our ſecond poſition, *viz.*

CHAP. III.

THat there is no *Fermentation* amongſt *mineral juices*, wherein an *acid* is not concern'd: Or thus, That an *acid* is neceſſarily requiſite in all *mineral Fermentations*: By *acidum* here I mean one of theſe two ſorts, (*viz.*) are ſuch as are imbred in the ſame *mineral concretion*, whilſt *in ſucco ſoluto, &c.* in the beginings of its generation: Or Secondly, a ſuperinduc'd *acidum*, which is powerful in the reductions of minerals already concrete; ſo that if we have our eye upon *Fermentation* from mineral concrete bodies, which have already paſt their *Embrio-ſtate*, and are come to the ſolidity of compleat bodies; then by *acidum* we do not mean ſuch a one as is intrinſick, connatural to, and implanted in all Brimſtones and *mineral Sulphurs*, more or leſs, for no *Sulphur* nor Sulphurous body as ſuch, can *alone* be the cauſe of *Fermentation* or *heat* in the Earth: but an *extrinſick* ſupervening *acid*, which muſt by reduction ſet thoſe *minerals* by a kinſhip or conſanguinity of parts into *Fermentation de novo.*

Now therefore it remains to prove, that there are *acid juices* in the *bowells* of the *Earth*: and that theſe are either *embryonative* to the ſame *mineral* where the *Sulphur* is, or elſe peculiar to ſome other bodies by which the tranſient waters become *acuated*, which if the former, then the *Acidum* and *Sulphur* being *natives* of the ſame *mineral*, do more eaſily by their mutual *contact* and *inteſtine* ſtruglings, cauſe a *Fermentation*, even whilſt the *minerals* are in *ſolutis principijs*, which being conſtant, thoſe waters which paſs through them muſt as certainly and conſtantly be *heated*. So that from the unerring rules of *nature* from perpetuating the cauſe, the effect muſt be no leſs: The *acid* which cauſeth the latter ſort of *Fermentation* we ſhall ſhortly touch upon.

Firſt then, the *acids* of the former *claſſis* will be apparent to us, if we conſider that there are no *minerals* produced in their peculiar *beds*, in the intrails of the *Earth*, without a previous *Fermentation* from their congenial principles of *Acidum* and *Sulphur*. For our *Hypotheſis* concerning the *generation* of *minerals* is grounded upon *Acid* and *Sulphur*; from which foundation we ſay, that theſe two being *actually* put into *motion* by the *mineral ſeed in Embrio*, diſtinguiſhed according to the *lubet* of the *divine fiat*, in the great *wheel-work* of *generation*, do by their mutual innate *wreſtlings*, cauſe a *Fermentation*, and this to be one (yea the chief) cauſe of *heat* in *natural Baths*.

Theſe in-dwelling *acids*, I ſay, are manifeſt, and eaſily diſcoverable to us *a poſteriori*, from their not difficult ſeparations out of the bodies of moſt known *minerals*, thus we ſee plenty of an *acidum* ſeparable from *common Brimſtone* by bare *flagration*, and the ſleight artifice of condenſing thoſe fumes: witneſs the Oyle of *Sulphur per Campanam*, which is *acid*: Thus alſo we have ſeparated an *acidum* from *Saturn Ore*; and know how to do the ſame from *Antimony*, both which are perform'd two manner of ways, *viz.* Firſt, By *ſeparating* their *Sulphurs*, (which I have done both from the *Ore* of *Saturn*, as alſo from the *minera* of *Antimony*) which by *flagration* like common *Brimſtone*, yield an *acid*. Secondly, By *diſtilling* the foreſaid *minerals* (I mean *Lead Ore*, and *Antimony*) *per ſe* in cloſe Veſſels by a peculiar way, may be drawn an *acid*.

Thus likewiſe out of both *Vitriol* and *Alom*, as alſo from *common foſſil* (which is all one, *marine*) *Salt* and Nitre by bare *diſtillation* in cloſe Veſſels are frequently *acids* drawn, which are ſingly or joyntly thence preparable, witneſs *Spirit* or Oyle of *Vitriol*, *Aqua fortis*, *Spirit* of *Salt*, *Spirit* of *Nitre*, &c. all of them ſufficiently *acid*. Thus out of all the *Pyrites* may an *acid* be ſeparated; yea further, out of *bitumens*, *amber*, *jet*, (which is *kennel coal*) and other ſorts of *Lythanthrax*, may by *diſtillation* an *acid Spirit* or *Liquor* be eaſily *ſeparated*.

parated. Thus my ingenious Friend Mr. *Fiſher* hath ſeparated an *acidum* out of a concrete *bitumen* got out of *Lead-mines* in the *Peake* in *Derby-ſhire* (not far from *Buxton hot Bath*) which is an *Electrical* Concrete, as alſo hath done the like from the reſt of the laſt recited *mineral bodies* : And the like *acidum* hath been drawn from a *bituminous fungus* found in thoſe parts.

Now come we to treat of our *ſecond* ſort of *acidum*, which is one of the chief ingredients or principles of our latter ſort of *Fermentation* to be numbred amongſt the cauſes of ſome *hot Baths*, and that is a *ſuperinduc'd acidum*, viz. the current of a living Spring (as ſuch are called) in its *ſubterraneal* paſſages, meeting with ſome *Salts* in *Embrio* or Bed of *Earth*, impregnated with *acid juices*, of which ſort are all or moſt of the *mineral Salts*, whilſt in *fieri* before they by a further maturity reach the ſtate of concretion, I ſay paſſing through theſe *Beds*, becomes (by reaſon of its facile *imbibition* of ſuch *juices*) *acuated* therewith, and then falling into a *bed* of *Brimſtone*, or other *minerals* or *pyrites*, *&c.* impregnated with *Sulphur*, begins a ſolution thereof, ſo raiſeth a F*ermentation* betwixt the *Sulphur* and the *ſupervening acid* : which gives *heat* to the *water*; and becomes more or leſs *hot*, according to the more or leſs powerfulneſs of the *Acid* and *Sulphur* as it paſſeth: As alſo according to the nearneſs or remoteneſs of the *waters exit* from the ſource of *Fermentation:* which *acid* dividing, ſubtilizing, and volatizing the *Sulphur*, doth brake it into ſuch ſmall parts, as that it becomes (I mean as to the pureſt part thereof) diſſolvable in *water* (according as we have more largely explain'd above) and thence it is (I mean from the *Fermentation* made from *Acid* and *Sulphur*, whether perform'd the former or latter way) that all *hot Baths* have ſomewhat of *Sulphur* in them more or leſs.

This laſt ſort of *Fermentation*, which I may call (if we have reſpect to the already concrete body of *Sulphur*, or Sulphurous *minerals*, and that not improperly) *Fermentation* at the Second hand, I ſay, is no leſs to be performed by *minerals* then *vegitables:* For as amongſt *vegitables*, Corn, when ripe and reap'd, its *fermenting* principles of *vegitation* (as we may elſewhere ſhew how all *vegitation* is nothing elſe but a *natural* ſlow-pac'd *Fermentation* from each plants peculiar *principles* of *Acid* and *Sulphur*) are ſhut up, and would conſtantly remain dormant, till it either be committed to the ground, in order to freſh *vegitation* and *multiplication* of its *ſpecies*, or be malted, whereby its *vegitative* *Fermentation* is perverted, and the ſame principles driven on to another deſign of *fermenting* in water after *malting*, in order to the making of our *drink:*

wherein both (*viz.* Vegitation and Malting) the ſame *fermentative* principles are kept afoot though to different ends.

So likewiſe it happens (by a parity of principles amongſt *minerals*, where when the *Fermentation* neceſſarily in their production ſometimes terminate in *concretion*, in which the *Sulphurous principle* (being prevalent) moſt what *coagulates* the *acidum*, and both with ſome other *heterogenious* parts, combine to the making up this or the other *mineral Sulphurous concrete*; I ſay there in that concrete the *principles* of *Fermentation* ceaſe to act, and ſo would (if unexcited) remain always dormant, untill by a *congenial* powerful ſupervening *acid*, the intrinſick *principles* be put into a freſh inteſtine *ſtrugling* or regular *motion*, which we call *Fermentation*, which *heating* the tranſient *waters*, becomes the efficient cauſe of ſome natural *hot Baths*.

CHAP. IV.

HAving already ſhewed that *Acidum* and *Sulphur* are the chief ingredients of *hot Baths*, as the eſſential principles thereof: Now come we to demonſtrate how and in what manner the waters in *hot Baths* become *hot*: which to do, we muſt endeavour to ſhew, that ſome ſorts of *acids* have ſo powerful an operation upon *Sulphurs*, or Sulphurous concretes, as that being *actually* ſet a work, or put into *motion*, are ſufficient cauſes of F*ermentation* in *mineral juices*; and next, that *heat* (which will neceſſarily follow) is the immediate reſult of ſuch F*ermentation*.

The Firſt we ſhall elucidate with an induction of many paralel inſtances, whereby we ſhall perform two things at once, *viz.* both illuſtrate our doctrine of F*ermentation*, grounded upon the genuine *principles* of *Acidum* and *Sulphur*, as alſo ſolve the *Phænomena* of the occurring inſtances: The firſt *mechanical* inſtance ſhall be, the ſolution of any *metall* (except Gold) in an *Aqua fortis*, and of Gold it ſelf in an *Aqua Regis*, which are no ſooner put together (both being duely qualified) but the *action* of F*ermentation* is plain to any eye, in the diſſolving or breaking to pieces that *metal*: what it is that cauſeth *Solution* and F*ermentation*, which immediately happens upon the working of the *ſolvent* on the *ſolvend*: It is not (as I conceive) from the complications of the *fluid Salt* in the *menſtruum*, with the *fixt Salt* in the *metal*, whereby the metallick *compage* is broke, and the *particles* thence hid in the pores of the *menſtruum*, according to the judgement of the learned Dr. *Willis*: Nor need we with him imagine a *vitriolick Salt* in *Silver*, or an *armoniack* in *Gold*,

Gold, but is it not rather the *Sulphur* in the *metal*, and the *acidum* of the *menſtruum*; for the ſake of which *Sulphur* the *mercurial part* is alſo broken to pieces, and the whole by that Fe*rmentative motion* diſſolv'd: *cujus Sulphuris intuitu totum liqueſcit metallum*, in which corroſion or ſolution of the imperfect *metals* in *Aqua fortis*, or the like corroſive *menſtrua*, there is no ſuch great danger of breaking the Glaſs if ſtopped, as happens inevitably in the ſolution of the *Sulphur* of the more *crude minerals*, the reaſon of which is from the more *fixity* thoſe *Sulphurs* arrive to by *metallization*, from what they are in unripe *marcaſites* or *minerals*. Hence we may certainly conclude, that in the F*ermentation* requiſite for *hot Baths* no *metals* are concern'd; and that both becauſe of the more *fixity* of their S*ulphurs*, as alſo from the deficiency of ſuch *corroſive menſtrua* in the earth: for nothing ſhort of an *Aqua fortis* or *Aqua Regis* can make a F*ermentation* with a *metal*. Hence alſo nothing but *minerals* (or *liquid bituminous juices*) wherein the connate *Sulphur* is of a more looſe compage, alſo more *volatile*, and conſequently eaſily *fermentable* by more lanquid *acids*, are the proper and eſſential ingredients of *hot Baths*; where we may obſerve both by the preceding, and by this following inſtance, That the S*ulphur* in the *metals* acting upon the *acids*, or *vice verſa*, are the true cauſes of corroſive F*ermentations*, and thence of *heat*. Thus the *caput mort'* of *viridaris* (from which I had according to *Zuelſer*, drawn off the *concentred acetum*) being a ſubtile calx of *Venus*, I mixed with an equal quantity of *Sal armon*: (in order to the preparing a ſort of that (vulgarly called) *ens veneris*) which mixture (being well impropriated by a ſufficient triture) within leſs then one quarter of an hour cauſed ſo ſtrong a *heat* as I could ſcarce get it into the *retort* without burning my hand.

The next inſtance therefore ſhall come nearer to the matter in hand, and that ſhall be concerning *Sulphurs* more *Crude*, as they ſtand related to the *minerals*. Thus in the affuſion of *Aqua Regis* upon *Antimony*, or Spirit of *Nitre* upon *butirum Antimonij*, where the *acidum* of the *menſtruum* acting upon, and *ſtrugling* with the crude *Sulphur*, either of crude ſolatary *Antimony*, or of the ſame carryed up by *Salts* in the form of a *butirum*, doth cauſe a very ſtrong *Fermentation*, where the *Sulphur* by the aſſaults of thoſe corroſive *acid Spirits* grows ſo high in its *Fermentation*, as that it almoſt takes *flame*, paſſing off with a ſtrong ſtifling and incoarcible *arſenical vapour*, by the former of which prepared with common Salt, my ingenious Friend Mr. *Wilkinſon* and my ſelf have after *Fermentation* ſeparated a *Sulphur* out of *Antimony*, not unlike the common greener ſort of *Brimſtone*.

That the *Fermentation* caus'd in the laſt of which experiments (I mean betwixt *Spirit* of *Nitre*, and *Butter* of *Antimony*) is not (as ſome might urge) from the *Salts* in the *Sublimate*, mixing with the *acidum* in the *menſtruum*, appeareth, becauſe the ſame *menſtruum* poured upon the ſame *Salts*, while incorporated with *Mercury* in the form of *Sublimate*, cauſeth no ſuch *Fermentation*; yea, on the contrary, I have ſeen *Sublimate* (wherein the foreſaid *Salts* are lodg'd, which are in *butirum Antimonij*) diſſolve in an *acid menſtruum*, without the leaſt tumultuous *Ebullition*, even almoſt like (and perhaps neer as ſoon) as Ice in warm water.

Another *mechanical* inſtance ſhall be from the pouring an *Aqua Regis* upon well dry'd *Danzick* vitriol, upon which well blanch'd, I poured the foreſaid *menſtruum*, from whoſe mixture (being made *per vices*) ſuch a ſtrong impetuous *Fermentation*, with thick *red fumes* was cauſed, as that it ſeemed to come little ſhort of *actual fire*, cauſing an *intenſe heat*: Now that it was the *Sulphur* in the *vitriol*, which meeting with the *acids* in the *menſtruum*, produced that *violent Fermentation* and *Heat*, is evident, becauſe out of a pound and a half of well dry'd *vitriol* after the *Fermentation* was over, and that the fumes had paſſed off in a *thick cloud*, there remained after the *ſolution* in a *diſtillation* in a coated Glaſs retort (being at length urg'd with a very ſtrong fire) ſcarce five Ounces of a Spongy red coloured *cap' mort'* totally inſipid. The like may be performed by *acids* upon any of the *Pyrites*, or other *imperfect minerals*, whoſe native *Sulphur* being crude, hangs but looſely in the *compage* of ſuch *concretes.*

That this foreſaid *Fermentation* proceeds not (as ſome may object) from the *Salts* in the *Vitriol*, is evident, becauſe if the *Salt* of *Vitriol* prepared by *Fire* (by whoſe ſtreſs the *Sulphur* is either baniſhed or fixt) be mixed with ſuch ſort of *acid menſtruum*, it cauſeth no *Fermentation*: beſides which, this *Fermentation* happens betwixt the *acidum* of the *menſtruum*, and the *Sulphur* of the *body* diſſolv'd, where there is no ſuſpition of *implanted Salts*, (other then what is *acid*) which the foreſaid inſtance of *Fermentation* from *aqua regia* upon *crude Antimony*, ſufficiently evinceth.

Laſtly, As *acids* working upon the *Sulphur* of *metals*, cauſe a *Fermentation*, and thereby their *ſolution*, and ſetting upon *minerals* (which comes nearer to our purpoſe) doth cauſe a moſt ſtrong *Fermentation*, unhinging their *Sulphurs*, which being unripe, are the more apt to *ferment*; So likewiſe meeting with *bituminous juices*, they do in like manner, become the *efficients* of *Fermentation*, which ſort of *bituminous Oyles*, I account to be of a middle nature betwixt *mineral* and *vegitable Sulphurs*, and therefore we ſhall *illuſtrate* the manner of their *Fermentation* with *acids* by *vegitable Sulphurs.*

And ſo *mineral acids* mixed with *vegitable Sulphurs*, cauſe *Fermentation* this threefold way, *viz.* Firſt, as meeting with them in a more ſolid ſubſtance, as with *turpentine*, *roſin*, *reſinous gumms*; or Secondly, in a more liquid form, as of *Oyles*; or Laſtly, in a *comminution* of thoſe *Oyles* into highly rectified *vinous Spirits*, where the *vegitable Sulphurs* are *comminuted* and *ſubtiliz'd* by *Fermentation* into ſmaller parts.

Thus as to the firſt, *aqua fortis*, with *turpentine*, *roſins*, or *reſinous gumms*, makes a *Fermentation*, which happens from their *implanted Sulphurs*, (mask in that ſolid form) and the *acidum* in the *menſtruum*. Hence it is, that ſome *reſinous gumms*, for inſtance *Camphire*, will diſſolve in *Spirit of wine*, or *aqua fortis* ſingly; but not joyntly, the reaſon whereof ſeems to be this, that in the former it diſſolves from the *analogy* of *Sulphurs* (*comminuted* and *volatiz'd Sulphurs* the more eaſily *permeating* from the *nimbleneſs* of their parts, the like *Sulphurs* lurking in more *ſolid forms*) which indeed is the reaſon why *vinous Spirits* are the proper *menſtrua* for diſſolving many *reſinous woods*, roots, gumms and *inſpiſſated juices*, as of *Turbith*, *Jallap*, *Mecoacan*, *Scamony*, *Myrrh*, *Aloes*, &c. by extracting their *reſinous* or *ſulphurous* parts. In the latter, (I mean *aqua fortis*) *Camphire* diſſolves from the *acidum* of the *menſtruum*, and from the ſame cauſe, (*viz.* of *acids* working upon *Sulphurs*) it is, that other *reſinous gumms* do alſo diſſolve in *acids*, as we find *Ammoniacum*, *Galbanum*, *Tachamahaca*, &c. do in Vinegar. But theſe two *menſtrua's* being mixed, after *Fermentation* degenerate into a *quid neutrum*, will not then diſſolve *Camphire*, as the ingenuous Dr. *Liſter* hath tryed.

As to the ſecond ſort, *Oyle* of *Vitriol* being mixed with *Oyle* of *Turpentine*, cauſeth a *ſtrong Fermentation* and *Heat*; and by *diſtillation* gives plenty of a *Brimſtone*: which *Fermentation* and *Seperation* of *Sulphur* being rightly underſtood, is (as we judge) from no other cauſe, then from the *acidity* in the *Vitriol*, working upon the *vegitable Sulphur* in the *Oyle*, and thence the *Fermentation*, (according to our *Hypotheſis*) whereupon having deſerted its own *mineral Sulphur*, contained in it ſelf, gives cauſe of the facile ſeperation of its formerly implanted *Brimſtone*.

Laſtly, Thus *Spirit of Nitre*, or *Oyle* of *Vitriol*, being mixed with a highly rectified *vinous Spirit*, (which is prepared from the *Fermenting juice* of *Grapes*, or with any other *vegitable fermentative Spirit*, doth preſently cauſe a *violent Fermentation*, which *heats* the Glaſs (its done in) ſo intenſely, as that it can no more be touched then *fire*; whoſe cauſe (as I apprehend) is no other then from the ſtrong *acidity* in the *menſtrua*, which meeting with the highly graduated *Sulphur* of *Vegitables*, in thoſe *admirable depurated* and *volatiz'd Liquors*, the one frets upon the other, cauſing that *inteſtine colliſion*, which we call *Fermentation*, whence immediately reſults the *heat*: which *Fermentation* betwixt the *Acidum* and the *Sulphur* in that *violent hurricane* of *rapid motion*, wheels off along with it a great part of the *Sulphur* contain'd in the *corroſive acid menſtruum*.

Another argument why the *Fermentation* in *mineral juices*, is the cauſe of *heats* in *Baths*, may be taken from the *perpetuation* of their cauſe; for ſeeing no other *inceſſant cauſe* can ſatisfactorily be aſſigned, which may in all things ſo well ſquare with the nature of *hot Baths*, as the aforeſaid, therefore till a more *rational cauſe* can be found out, (if any ſuch there be in nature) it may not be unacceptable to the ingenious.

Now that their cauſe is certain and conſtant (according to our depoſited *Hypotheſis* of *Fermentation* of *minerals* in their production) is evident from their continual *generation*; for where once begun, they ceaſe not to *perpetuate* their *Offſpring:* which is evident from the obſervation of *Mine-works*. Thus *Salt-peeter men* find, that when they have extracted *Salt-peeter* out of a floor of Earth one year, within three or four years after, they find more *Salt-peeter* generated there; and work it over again, the like is obſerved (as Dr. *Jorden* notes) in *Alom* or *Copperaſs* or *Vitriol*. And this is not only uſual to all *minerals*, but alſo the ſame may be ſaid of *metals:* For the *Tinners* in *Cornewall* have experience (as the foreſaid Author well obſerves) of *Pitts*, which have been filled up with Earth after they have wrought out all the *Tin* they could find in them, and within thirty years they have opened them again, and found more Tin generated: The like hath been obſerved in *Iron*, as *Gaudentius Merula* reports of *Ilva*, an *Iſland* in the *Adriatick Sea*, under the *Venetians*, where *Iron* breeds continually as faſt as they can work it, which is confirm'd by *Agricola* and *Baccius*, and by *Virgil*, who ſaith of it,

Inſula inexhauſtis Chalybum generoſa metallis.

The like is found at *Saga* in *Lygis*, where they dig over their *Iron mines* every *tenth year:* *Matheſius* alſo gives examples in almoſt all ſorts of *minerals* and *metals*, which he hath obſerved to grow and regenerate. *Eraſtus* (as Dr. *Jorden* notes) affirms, that he ſaw in S. *Joachims Dale*, *ſilver* grown upon a beam of wood, which was placed in the Pit to ſupport the works: The like of reproductions of *metals*, is alſo obſerved in the *Lead-mines* at *Mendip* and the *Peake*, which do not onely ſtretch further in extent of ground, then hath been obſerved heretofore, but alſo are renewed in the ſame ground, which hath been formerly wrought, which we have touch'd upon in our *Hydrological Eſſays*.

Wherefore ſeeing *minerals* are continually generated, their conſtitutive *principles* in their *fermental operation*, muſt as conſtantly be at work, eſpecially where concretion is interrupted by a continual flux of *water*, as happens in the ſource of moſt of theſe *hot Baths*.

Now where the ſeeds of *minerals* are once begun, that their active *principles* are ſet a work, in order to the heaving forth a body anſwerable to the type *implanted* in the *primordials* thereof. If this happens, I ſay, where *water* in his *ſubterraneous paſſages* hath its conſtant current, it can never arrive at the compleating of the body according to the intention of *nature*; for although it be always aiming at the perfecting of a ſolid concretion; yet the conſtant afflux of *waters*, impedes that attempt, and onely ſerves to keep the *fermentative principles* in a conſtant motion; ſo that *water* doth but ſet the *inbred principles* of *Acidum* and *Sulphur* more into an *inward ſtrugling*, and makes the *Fermentation* the ſtronger, and conſequently the *greater heat*, a very pertinent inſtance, which may lead us to a better and more familiar underſtanding, how this *Fermentation* is promoted by *water*, we may (not unaptly repreſent by *Oyle* of *Vitrioll* and *Water*; for a little *water* being put thereto, it preſently ſets the *fermental principles* of *Acidum* and *Sulphur* (connatural to that Oyle) into a ſtrong *Ebullition* or *Fermentation*, whence reſults ſo great a *heat* as the Glaſs (its done in) is ſcarce tollerable to the hand; eſpecially if the Oyle be well rectified: whereas, before the addition of *water*, the Glaſs (wherein was the *Oyle*) was cold to touch, the *principles* lying *dormant* from the *thickneſs* of the *Liquor*, and its tendency towards the *concretion* of a more *ſolid body*; but upon the addition of a little *water*, it thins that *Liquor*, at leaſt in ſome *meaſure*, and ſo puts the foreſaid *principles* into *Fermentation*: And that in the production or generation of *minerals*; *Fermentation* of their implanted *principles* is chiefly concern'd, is further evident in what *Agricola* and *Eraſtus* ſaith from the *obſervation* of *Mine-works*, who affirm, That in many places they find their *Mines* ſo *hot*, as they can hardly ly touch them; from the ſame reaſon of *Fermentation* it is, that the *minera* of *Allom* or *Vitriol*, being broke and expos'd to the air, contract a *ſtrong heat*, which ſometimes may ariſe to that height, as to cauſe an *actual ignition*, by which, not long ſince, a *Barne* at *Yeeland* near *Hallifax* was burnt; and from the ſame cauſe the *minera* of *Tin-Glaſs* being expos'd to the moiſt *air* will become *very hot*; for upon the acceſs of *moiſture* in the *air*, the intrinſick *acids* of the foreſaid *minerals* are diſſolv'd, which as they diſſolve *work* upon their implanted *Sulphurs*, from whoſe mutual *Colliſion* and *Colliquation* is caus'd the foreſaid *Fermentation* and *Heat*.

CHAP. V.

HAving thus delivered our *Hypoheſis* of the cauſes of *hot Baths*, from the *Fermentation* of *mineral juices*, whoſe *mechanical* and efficient *principles* conſiſt in an *Acidum* and *Sulphur*, it will not be difficult from hence to ſolve various other *ſubterraneal phœnomena*, ſuch as are damps, (and from thence the *reaſons* of poyſonous *Springs*, *Baths*, *Pools*, *Lakes*) alſo *Earth-quakes*, *Erruptions*, &c.

Firſt, As to *Damps*, to me they ſeem to be nothing elſe but certain *guſts* or *ſteams* ariſing from *mineral* Fermentations, which are more or leſs *noxious* or *mortal*, by how much they proceed from *minerals*, whoſe *Sulphurs* are more or leſs *venemous*: for if either a *Fermentation* happen in the very *generation* of ſome *poyſonous mineral*, as ſuppoſe *Arſenick*, *Riſogalla*, *Auripigmentum*, *Sandaracha*, *Ruſma*, *Cadmia*,&c.from the inteſtine *ſtruglings* of their innate *Acidum* or *Sulphur*; or if it happens from the ſupervening of an *acidum* upon the *minera* of any of the aforeſaid *poyſonous juices*, I ſay from either way an *effluvium* doth forthwith *ariſe*, which (being the product of *Fermentation*) is very *ſubtile*, and thereby can eaſily *permeate* the *Cranies* of the *Earth*, and reach at a great *diſtance* from the firſt *ſource* of *Fermentation*, which is able by its *Sulphurous Arſenical* odour, not only to *extinguiſh* a Candle or Lamp, but alſo *exſufflate* or puff out the very *vital taper* of men or other *animals*, that it meeteth with in *ſubterraneal paſſages*, whence many men have *ſuddenly periſhed* by the breath *thereof* in *Mines*: yea ſo ſtrong is it ſometimes, or in ſome places, that it *infects* ſome *waters* that lie over it, or come within the *orb* of its *action*; whence poſonous *Springs*, *Baths*, *Pools*, *Lakes*, &c. take their *begining*, which will *kill* ſuddenly, as at *Circum* in *Thracia*, *çia, Fons Neptunius in Terracina*, at *Perant* by *Mompelier :* the Lake *Avernus*, the Cave of *Charon* by *Naples*, &c. yea, from hence thoſe *waters* take their *original*, which by their *mortal odours kill Fowl* that *fly* over them, of which ſort are the foreſaid Lake *Avernus*, as alſo the *vapours* ariſing from *Charons den*, between *Naples* and *Puteolum*, &c.

Next to which, the *Phænomena* of *Earthquakes* are (from the aforeſaid *principles*) not difficult to *ſolve*, if we in rendring an account thereof, ſhall ſay, that they are likely to happen, when ſome *Sulphur* or *Sulphurous body*, either in *Liquid* or *Concrete*, meets with a *fermenting acidum* in the *bowels* of the *Earth*, in ſome *narrow paſſages*, where, when that *elaſticity* and *exploſiveneſs* of *Sulphur* by a *ſupervening acid* is *excited*, and being *pent up* in the *ſtraights* of the *Earth*, cannot eaſily get *forth*, forceth and preſſeth on all hands upon the *adjacent bulkes*, heaves and lifts like a *mole* in its *ſubterraneous workings*, and thence cauſeth that *terræ tremor*, which may not improperly (amongſt the reſt) be illuſtrated by theſe following *inſtances :* Firſt, I took *floores* of *Brimſtone* (which is all one with *Crude Brimſtone*) two drams, upon which I poured about *half an Ounce* of that ſort of *aqua regia*, which is called (by Mr. *Boyle*) *menſtruum peracutum*, which though at firſt, for a while, it kept *quiet*, cauſing no ſenſible *ebullition*, but afterwards the *menſtruum* began to *work* thereon, and to bring the *Sulphur* to a *gellied matter*: this Glaſs I ſet looſely upon the very ſurface of my Sand *digeſting Furnace*, whoſe *heat* was very *ſoft* and *ſlow* (poſſibly the ſame might happen though it had no *external warmth* at all) yet although the Glaſs had a long neck (being a bolt head) and but ſleightly crack'd, it *broke* all in *pieces*; and with the force thereof broke another Glaſs by it.

Thus Secondly, by putting one Ounce of *Sal armoniack* to four of *Aqua fortis*, if the Glaſs Viol be *cloſe ſtopt*, it will preſently with a great noiſe *break* the *Glaſs* into a Thouſand *ſhivers*; for the *acidum* in *Common Salt*, which is in *Sal. armoniack*, meeting with the *Sulphur* in the *Aqua fortis*, ſets upon it, whereby a *ſtrong Fermentation* is preſently raiſed: which *wanting room*, breaks all in *pieces* before it.

Thus Thirdly, by pouring *Aqua regia* upon *Antimony*, or the *Spirit* of *Nitre* upon *butirum Antimonij*, put into Glaſſes, or the *ſtrongeſt* of *Veſſells*, and cloſe ſtopt up, would break them (though never ſo ſtrong) into many pieces; and that from the foreſaid *Fermentation*, which happens from the *acidum* in the *menſtruum*, and the *Sulphur*, either in *crude Antimony*, or the *Butter* thereof; many more of which ſort of *experiments* we further illuſtrate in our *Halologia Chymica.*

Thus alſo from the aforeſaid *experiments*, may (without any more ado) an *account* be given of many *ſubterraneous Eruptions :* for I have by them at once given a *ſufficient demonſtration* (as I think) both of the *reaſons* and *cauſes* of *Earth-quakes*, and alſo of *Eruptions*, inaſmuch as that *Fermentation* from *mineral juices* made in ſtraight *meanders* of the *Earth*, when it cannot find *vent*, if moderately ſtrong, they only cauſe *terra tremor* ; but if very *violent*, even nigh an actual *flagration*, then the greater the weight of *Earth*, *Rocks*, or other *matter* is, which lieth upon it, the *ſtronger* and more *hideous* are the *Eruptions :* breaking in *pieces* all before it. So that I ſuppoſe all *Eruptions* and *ſubterraneal belchings*, to proceed from one of theſe two cauſes, *viz.* either from *ſubterraneal fires* of *Sulphurous minerals* actually, but accidentally *kindled*, witneſs thoſe *Vulcano's* of *Ætna*, *Viſuvius*, *Strongilo*, &c. of which we have diſcourſed in our *Hydrological Eſſayes*, or elſe from *ſubterraneal Fermentations*, amongſt which, ſome may poſſibly riſe ſo *high* and *ſtrong* from the great plenty of *Sulphur* and *Acids*, ſet into an *actual Ebullition*, as that they may (by the *air* which may probably reach them through ſome ſmall *crevices*) actually *take fire* and *burn*. Thus beſides the foreſaid

ſaid inſtances, if *Spirit* of *Wine* be mixed with *Spirit* of *Nitre*, or be added to a *mixture* of *Oyle* of *Vitriol*, and *Spirit* of *Nitre*, maketh an exceeding *ſtrong Fermentation*, even almoſt into an *actual flame*; and the Glaſs will be intenſely *fiery hot*, as that ones hand may as long endure a *hot cole* as it, which if pent up, would for want of room to *expand* it *ſelf* in its *Elaſtick power*, would I ſay, by its *exploſive force*, break all before it.

In the next place, we ſhall endeavour to *demonſtrate*, how, from the premiſed Doctrine of *mineral Fermentations*, may alſo, not onely *Brimſtone* or other *mineral* concrete *Sulphurs* be generated *de novo*, in ſome parts of the *Earth*, but likewiſe how many of the *fontes acidi* may thence take their *original*. As to the *generation* of *concrete Sulphurs*, we ſuppoſe it thus, *viz.* when or where a *ſtrong Fermentation* happens from *mineral juices*, whilſt in *Embrio*; and that there is no immediate *current* of *waters* to carry off the looſer part of the *principles*, as they *ferment* (as happens in all *hot Baths*, as we have before *ſufficiently declared*) which not being *pent up*, as happens in the moſt uſual *Earth-quakes* and *Eruptions*, as aforeſaid, but finding room enough in the moſt potent places of the *Earth*, *percolates* ſome more looſe *bed of Earth*, and thereby leaves that *Sulphur* (which was carryed up along with the *fermenting ſteam*) as it were in the *filter*; For that the *acidum* being *prevalent* in the foreſaid *Fermentation*, may in thoſe *ſteams* it ariſeth with the *Sulphur*, in ſome *peculiar colanders* of the *Earth*, deſert its former *companion*, may ſomewhat appear to us, by pouring *Oyle* of *Vitriol* upon *Antimony*, or the *minera* thereof, and diſtilling it thence. The *Sulphur* in the *Oyle* after *Fermentation*, becomes ſeparated, and as it were *percolated*, by the body of the *Antimony*, while the *acidum* ariſeth more ſimple, leaving the *Sulphur* behind, which afterward by a *ſtronger fire* is carryed up in the form of *Brimſtone*, taking along with it (through the congenialneſs of parts) ſome of the *Sulphur* of *Antimony*.

Next to which, how many of the *fontes acidi*, may from the foreſaid *Fermentation* of *mineral juices*, take their *original*, we ſhall thus *explain*, viz. by ſuppoſing that in ſome *mineral Fermentations*, whilſt in *Embrio* (and where no current of *waters* nor ſtrait paſſages happen, for cauſes aforeſaid) the *Ebullition* from their *Acidum* and *Sulphur*, may be ſo *intenſe*, as that thereby a *freſh acidum* may be ingendred, or the former multiplyed (*vires acquirit eundo*) with deſerting *Sulphur* its *companion* in the *colander* of ſome *Earths*, may be *ſublim'd* and carryed in *ſteams* (as a thinner and more ſubtile *acidum*, at a great diſtance from the *Source*) where afterwards, touching upon and *irroreating* ſome *Earth*, or ſome *Stammina* of the *mineral beds* of *Iron*, or *Alom-ſtone*, impregnates them to further uſes :: So that where a *current* of *water* toucheth either upon that *Earth*, and afterwards upon either of the foreſaid *minera's*, or doth touch upon thoſe *minera's* impregnated with the aforeſaid *acidity*, I ſay, either way are made *vitriolin* or *aluminous waters* or *ſpaws*.

Now that an *acid* may (after the foreſaid manner) thus aſcend from *fermenting juices*, barely from the *Ebullition* of the *principles*, even without any *extrinſick heat*, will appear from this following *mechanical experiment*, viz.

I poured ſix Ounces of rectified *Spirit* of *Wine* upon half a pound of *Spirit* of *Nitre*, which I put into a double *bolt head*, with a pretty *long neck*, after a while, as ſoon as the *vinous Sulphur* in the Spirit of *Wine*, had ſet the *Acidum* and *Sulphur* of the *Spirit* of *Nitre* a work, they cauſed ſuch a *furious Fermentation*, that it *drive* up the *ſtopple*, and *forc'd* it ſelf forth up to the *top* of the *Room*, whereby a great part was loſt, whereas, if the Glaſs had been very cloſe ſtopt, it would without doubt have *broke* the *Glaſs* into *ſhivers* : to what was ſav'd, I added of the ſame ingredients of each four Ounces, it began, after a while, to fall into a *ſtrong fermenting Ebullition*, ſo boyl'd, and bubled forth very *fiercely*, and ſent forth a *ſtrong fume*, which *heated* the *Glaſs* ſo *intenſely*, as I could not *hold* the very top of it in my *hand*, then I ſet a ſmall *Glaſs-head* over the Glaſs, to *condence* ſome of the *fumes*; which I found gave a very *ſmart acid Spirit*, not but that there are other cauſes of ſome of the foreſaid *acidulate Spaw-waters*, concerning which, we have at large diſcourſed in our two books of *Hydrologia Chymica*, and its *Vindication*.

And now that I have laid down my *Hypotheſis* of the cauſes of *hot Baths* (branch'd into many ſorts) *ſubterraneal Damps*, *Earthquakes*, *Eruptions*, *Regeneration* of ſome *Sulphurous concretes*, and of the *original* of ſome of the *fontes acidi*, all from the *Fermentation* of *mineral juices*, as aforeſaid; which how well grounded, and how further *improveable*, I ſhall leave to the unbyaſſed reader to *examin* and *judge*; as alſo to conſider, whether from the ſame *Hypotheſis* or ſuppoſition of cauſes, may (and that not impertinently) be ſolved the *Phœnomena* of the *diverſity* of *Winds*, the *viciſſitudes* of *heat* and *cold*, the reaſons of *Snow*, *Hail*, *Meteors*, and other *apparances*, common to, and peculiarly obvious in the *Atmoſphere*. So here, I would take an occaſion from the nature of the foreſaid *Fermentation*, to inſiſt a little upon the two grand *Phænomena's* of *heat* and *light*, found in concrete bodies from the ſame *principles.*

CHAP. VI.

I Shall not here (by climing ſo high) inſiſt upon the cauſes of *heat* and *light*, in that great and inexhauſtible *Fountain* thereof, the *Sun*; whether its perpetual *Spring*, and inceſſant *emanation*, may not conſiſt in a peculiar *Fermentation* of its own, ſet a work by the *divine Fiat*, and kept a foot by a continual *circulation* of *æthereal matter*, concerning which, we may *elſewhere* modeſtly propound our *thoughts*, nor ſhall I deſcend ſo low, as to treat any further of the *cauſes* of *heat* in thoſe known *ſubterraneal Vulcano's.*

But ſhall at preſent make it my *task* in *ſhort* to ſhew, Firſt, That *Fermentation* is made from the *mutual ſtruglings* and *inteſtine combatings* of *Acid* and *Sulphur*, in all *juices* and *concrete bodies* where it is *evident*: And how *heat* is produced from *Fermentation* in all ſuch bodies where it is found. Secondly, To ſhew how from the ſame *principles*, and after what manner, *light* is *made.*

That *Fermentation* and *Ebullition* in *mineral juices,*

juices, whether naturally or artificially *prepared*, proceed not from the *contrariety* of *Salts* (as many *worthy perſons* urge) is evident, becauſe there is no ſuch *Ebullition* amongſt *Salts*, but what are from the *contrariety* and *ſtruglings* of *Acids* and *Alcalies*, whereas no man ever yet could make it appear that thoſe *minerals* either in *ſucco*, or in *actual concretion*, contain'd any ſort of *Alcalies*, either *fixed* or *volatile*. But on the contrary its moſt certain, from *irrefragable experiments*, that *Sulphurs* and *Acids* are ſeparable from them all.

And as before we have ſhewed, the *Fermentation* of *minerals* to conſiſt in the *colliſion* and *inteſtine wreſtlings* of their *Acid* and *Sulphur*, as the cauſes of *hot Baths*, &c. So the *Fermentation* in *animals* is no leſs *obſervable* to *proceed* from the like inward *ſtruglings* of their imbred *Acid* and *Sulphur*, continually (till they dye) kept on foot in the body of *animals*, and that will appear, if we conſider their implanted *acid juices* (the very *foundation* of all *Ferments*) and the daily *occurrence* of ſuch ſort of *Food*, in whoſe texture both *Acid* and *Sulphur*, chiefly *Sulphur*, doth *reſide*, in order to the keeping thoſe *Ferments* at work, for the *nouriſhing* and *upholding* the *fabrick* of thoſe *bodies*.

The firſt *wheel* (as I may ſay) of theſe *Ferments*, or the *primordial Stamina* of *acids* *in animal bodies* (after their *formation*) are placed in the *Stomack*, where the *Fermentation* begins from the native *acidum*, acting upon the *acquired Sulphur* of nutritive *food*, and is carryed on into the *ſecond* digeſtion into the *inteſtines*, where a freſh gentle *acidum* from the *pancreatick juice*, and a *Sulphur* from the *Gaule*, ſent thither by the *ductus biliaris*, promote and aſſiſt a further *Fermentation*, and thence carryed into the *blood*, where the ſame *principles* of *Fermentation*, together with a *volatile Salt*, complicated with the *Sulphur* and *Acidum*, are ſtill at *work*, and undergo new *ſeparations* and *depurations*, as alſo acquire new helps of *volatization* from the continually *inſpired Air* into the *Lungs*, (through which the *blood* paſſeth) which ſtill *promotes* the begun *Fermentation*, in order to the *circulation* thereof, and nouriſhment of the *whole*.

So that the *native acid juice* of the *Stomack*, is not in a ſtrict ſenſe a *Ferment*, till ſuch times as it finds ſome *Sulphurous food*, upon which, as its *proper ſubject*, it begins to *work*; and then upon its *action*, *colliſion*, and *mutual ſtrugling* with the *Sulphur* in the *aſſum'd aliment*, begins the *Fermentation*, which being *vital*, we ſuppoſe to be the very firſt *ſpring* of *heat* in the *animal body*, after it hath paſſed its *Embrio-ſtate*.

Yea, all the reſt of the *Fermentations* in the *body*, are but the *continuations* of this *Fermentation* begun in the *Stomack*; for the *blood* is made up of that *Chyle*, which by *Fermentation* is wrought in the *Stomack*, retaining ſo much of its *firſt principles* of *Acid* and *Sulphur*, mixed in a juſt *temperature* (aſſiſted with the *pancreatick* and *bilous juices*) as may be ſufficient to keep that *Liquor* ſtill in a *Fermentative motion*, ſuch as may help to ſupply with a new off-ſpring of *animal Spirits* (the very product of that *Fermentation*) as alſo to fill up the *interſtices* of that *matter*, or thoſe *parts*, which are *continually* upon the *wheel*, winding off through the *perſpirable Portals* of the *body*, as we may elſewhere, God willing, take an occaſion *further* to *diſcourſe*.

How powerful a *menſtruum* this *Stomachial acid* (the firſt efficient of heat) is, doth appear both by the great force of *working* upon, and *diſſolving* all *alimentary things*, which are all of them ſuch, as wherein *Sulphur*, whether *vegitable* or *animal*, is more or leſs *complicated*, and *cujus intuitu*, *viz.* for the ſake of which, all the reſt wrapt up in the ſame *concrete*, are alſo *diſſolved*, as likewiſe doth appear from thoſe ſtrong *vellications* of the *Nerves* and *Tunicles* of the *Stomack* upon *hunger*, being a nothing elſe but that aforeſaid *acid menſtruum*, preying upon the next *adjacent parts*, through the want of ſome *Sulphurous* ſubject to *work* upon.

That *Sulphurous concretes*, whether *animal* or *vegital*, are the proper Subjects for the *native acidum* of the Stomack to *work* upon, in order to *Fermentation*, is clear; becauſe neither *Stone*, *Clay*, *Earth*, *Marle*, *Wood*, nor ſuch like, wherein are no *Sulphurous parts*, or at leaſt, ſuch as are not *congenial* to the foreſaid *acidum*, can become capable of being *food*, inaſmuch as no *genuine Fermentation* (eſſentially neceſſary to the upholding the *fabrick* of an *animal body*) can thence be made.

Not now further to ſhew, how *Fermentation* begun in the *Stomack*, and carryed on in the *blood*, and other *humours*, is not onely the *efficient cauſe*, and *effectual ſource* of *heat*, but alſo of all *animal* Spirits, carryed thence by the *conduit-pipes* of the *Nerves*, into the *habit* of the *body*, in order to the *performing* thoſe peculiar *functions* of ſenſe and motion, both (*viz. heat* and *animal* Spirits) being the immediate *products* of animal *Fermentations*.

We ſay, that in the circle of *natures operations*, throughout her *triplicity* of *bodies*, there is no ſuch thing as *Spirits ſeparable*, but what are the *immediate* reſults of *Fermentation*: For, however, among ſome *Phyſiologiſts*, they are reputed *inter principia corporum*: yet according to our *Hypotheſis*, they are no *principles*, but the *poſterior products* of *Fermentation*, and appear in bodies according to the *ſlow* or *quick*, low or high *degrees* of *Fermentation*, from whence proceed their threefold order in the *productions* of *concretes* : For either theſe *Fermentations* are to be conſidered in their *primordials*, or firſt *workings* in *bodies*, in order to the *fabrick* thereof, and ſo the *Spirits* which thence reſult are in a low depreſſed ſtate, *deeply immers'd* in corporeal bulk, as appears in *vegitables*, &c. in their ſtate of *Infancy* and *Crudity*.

Or Secondly, Theſe *Fermentations* are to be conſidered in the further *progreſs*, and cloſer *interweavings* of the *principles*, whereby they become to be more *quick* and *high*; the *Sulphur* gradually *ſoftening* and *ſweetning* their *connate acids*, and thence the bodies wherein thoſe *Fermentations* happen, becomes more *pregnant* with *Spirits*, being now more plentifully *ingendred*, and more *eaſily* ſet at liberty by the power of *Fermentation*, then before: And this is evident in *all things* brought on to *maturity*, and becomes ſenſibly *apparent* chiefly in all *odorous Plants* and *Fruits*.

Or Laſtly, They are to be conſidered in the more ſenſible *brisk conflicts* of the *principles*, even after the *bodies* they work in are brought to *maturity*, one dulcifying the other, by the *concurring cauſes* of ſolar heat, *&c.* the *principles*, I ſay, being yet kept on in *motion* in all *fermentable juices* and *grains*, do produce the greateſt plenty of *Spirits*, which being ſet at *liberty*, are all thoſe we call *vinous Spirits*, in animals thoſe we call *animal Spirits*, the genuine product of *vital* and *animal Fermentations*, and in *minerals* their *Spirits* in ſome places after *beating* tranſient *waters* for *hot Baths*, appear in *volatiz'd Sulphurs*, otherwhere in *ſubtile acids*, as the cauſes of ſome *acidulæ*; and elſewhere in *apporrhea*, *ſteams*, &c. (as elſewhere we have ſhewed) Thus in all fruits, brought on to *maturity*, and all *grains* ripened for the *harveſt*, the *principles* in their mutual *Colliſions* are ſo *pregnant*, as that by being put nearer together (which happens by their being *juiced* or *malted*, they are thereby ſet a *work* into a ſenſible *Fermentation*, as appears in all *fermentable juices* and *malted grains*, the immediate reſult of both which, are *vinous Spirits*.

Thus in all natural *animal Fermentations* of their *juices*, requiſite for *circulation* of the *blood*, nouriſhment of the *body*, and for the performing other *functions* peculiar thereto, the *animal principles* are ſo *pregnant*, as in their continual *wreſtlings* and inward *colliſions*, inceſſantly to produce ſuch a *ſtock* of *Spirits*, as being rightly *diſpoſed*, and carryed in their *proper Conduits*, the Nerves are ſufficient to the *abſolving* the functions of *ſenſe* and *motion*:

And the like in their kind may be ſaid of *minerals*, concerning which, *viz.* the origin of *animal Spirits* from the foreſaid *Fermentation*, we may elſewhere largely diſcourſe.

We ſhall only ſay at preſent, that as the *natural Fermentations* in *animal bodies*, are produced from the *inteſtine colliſions* and inward ſtruglings betwixt the *native acid* of the Stomack (fortified perhaps by ſome *connatural acidum* in the aliment) and the acquired *Sulphur* of *nutritive concretes*, ſeparating *Hetrogenities*, and graduating themſelves by *ſucceſſive depurations*, till they in their proper *juices*, perform thoſe *circulations* requiſite to the peculiar *functions* of the *body*. So likewiſe from the *Cataſtrophe* of the natural, and ſuperinduction of other not *congenial acids*, may be made ſuch *mortifications*, *precipitations* and *depravations* of the genuine *ferments*, and ſuch new *complications* betwixt the *recent acid*, and the *Sulphur* in the otherwiſe natural *fermenting juices*, as to lay a foundation of new ſpurious *Fermentations*, the cauſes of *Feavers* of all ſorts.

Not to ſay here, how moſt, yea, (for ought I know) all ſorts of *Feavers*, are nothing elſe but *ſpurious Fermentations* of the *blood*, and other *juices* of the body, diſtinguiſhable, or (if I may ſay) *ſpecificated* by variety of *acids*, not *congeneal*, but wholly diſagreeable, gradually heightening the natural, and otherwiſe ſlow pac'd *genuine Fermentations :* whoſe various degrees of *Feavers* are moſt what *differenced* or *ſpecificated* from the low or high, ſlower or quicker degrees of *ſpurious Fermentation :* or to ſpeak in a more plain *dialect*, how *Feavers* are various ſorts, or different degrees of *inflamations* of the *blood* and other *juices.* For an *inflamation*, according to our *Hypotheſis*, is nothing elſe but a heightening of *Fermentation* from a more ſtrong *colliſion* of the *principles*, whereby, from their *mutual wreſtlings*, they arrive to the height of *cauſticks* (which as we ſhew elſewhere, differ from *corroſives*, onely from the difference of their *acids*) ſuch I mean, as in a lower degree pleuriſing from an inflamatory tranſpoſition of the fiery particles of the *blood* upon the *pleura*, and in a higher degree, as are the plague and peſtilential *Feavers*, which are *Feavers* in their higheſt inflamatory and fiery degree, witneſs the *Anthraſes*, *Carbuncles*, and other *peſtilential badges*, which ſhew perfect *Eſchars* upon the skin. as if perform'd by *cauteries Lixivial*, or fiery : which are with due caution to be cured by ſuch *ways* and *methods*, as allay that *furious fiery Ebullition* by *Phlebotomy*, and gentle breathing *Sweats :* but here we muſt cut ſhort, intending (as this finds acceptance) a fuller and more free *diſcourſe* of the nature of *Feavers*, how eſſentially *ſpecificated*, and what *methods* accordingly they beſt *yield too*; concerning which, we may (*Deo dante*) treat in another place.

Onely this (by the by) we would obſerve, that amongſt *animal juices*, thoſe from *vegitables* made by *animal Ferments*, ſuppoſe *Milk*, by the various actions of the *innate* or *adventitious acids*, upon their inbred *Sulphurs*, happen different products: Firſt therefore, as to the *coagulations* and *alterations*, to be made from the inbred *acidum* thereof.

Thus *Milk*, while in an equal temperature of its *conſtituent ingredients*, undergoes no ſeparation of parts, remaining in an *uniform Liquor*, but being expos'd to the *Air*, after a while the *innate acidum* of the *Milk*, being acuated by that of the *Air*, makes a *ſpontaneous* ſeparation of a *cremor* from the more thin part, which *Cream* having ſome *acidum* in it, (as we elſewhere prove, that all *Cremors*, *Oyles*, *Fatts*, *Axungia's*, &c. are but different diſguiſes of *animal Sulphurs*, have their implanted *acids*) by keeping, grows more *ſour*, this by concuſſion of the parts (in that motion we call *Churming*) undergoes a *Fermentation* of its kind; from whence happens another ſort of *ſeparation*, *viz.* into *Butter*, (which is *Sulphur* in another form then before) and a more ſerous part, call'd *Butter-milk*.

And as *Milk* after the ſeparation of *Cream*, by longer ſtanding, comes to a *thick*, and almoſt *gellyed conſiſtence* (by Countrey people call'd *Loppard*) and by a little heat ſplits into *Curd* and *Whey* : ſo *Butter-milk*, if kept long, will come to the like *conſiſtence*; but if *heated*, the *acidum* preſently *coagulates* the *Curdy part* : if that coagulation be made in *heat* after the mixture of *New-Milk*, the *acidum* in the *Butter-milk*, *coagulates* both the *Curdy parts* of its own, as alſo *Butirous* and *Curdy parts* of the *New-milk*, into that ſort of ſour *coagulum* call'd *hatted Milk*, which is more or leſs *ſour*, according to the prevalency of the *acidum*, or more or leſs affuſion of *New-Milk*.

And Laſtly, As the foreſaid *alterations* are made from the various *coagulations* of *Milk* from its implanted *acid.* So likewiſe other ſorts of *coagulations* thereof are produced from *additional acids* : Thus any *Fermentative potable Liquor*, as *Wine*, *Ale*, *Beer*, *Syder*, &c. mixed with *Milk*, the *acidum* in ſuch Liquors coagulates the *Sulphurous parts* into a *Curd*, ſeparable from the *ſerus Liquor*; the like will a few drops of any *acid juice* do, whether *vegitable* or *mineral*, as of *Vinegar*, *Vitriol*, *Sulphur*, *Salt*, &c. yea, the *runnet* which is made up of *Milk coagulated* by the Stomichal *acid* of an *animal*, which by keeping, *ſours* yet more, and is made up with *Salt* to preſerve it from decaying, by the addition I ſay of the foreſaid *acidferment*, or *animal Runnet*, to *Milk* eſpecially in *heat*, is made that *coagulation* of the *Sulphurous* and *Curdy parts*, out of which our Cheeſe is uſually made.

So that from the different actions of the *acid* (whether native or additional) upon the *Sulphur*, are produc'd thoſe uſual *concretions*, or rather *coagulations* of *Butter* and *Curds*, ſeparable from the more *liquid ſerum*: which *Butter* has alſo its connate *acid*, which is the cauſe of its *liquidity* in *heat*, and *coagulation* in *cold*, as we could ſufficiently demonſtrate the *liquidity* and *coagulation* of ſuch, the *ſucculency* and *concretion*, the ſoftneſs and hardneſs of other ſort of bodies, chiefly to depend upon the various modes of *acids*, either conſidered in *Fermentation* or *Concretion*, and as aſſiſted by other concurring cauſes, chiefly of the *Air*, which we now with difficulty, and chiefly for brevity ſake, refer to another place.

We might (if willing to inlarge) take an occaſion here amongſt *animal Ferments*, to inſiſt upon the *cauſes* and *reaſons* of thoſe ſtrangely ſurprizing *effects* reſulting from the invigorated *Ferments* of ſome *venemous animals*, and ſhew, that all their *poyſonous properties* conſiſt chiefly and ſolely in the *Ferments* of their *juices*, which may be invigorated to that height, as to become *poyſonous Fires*, which by a bite (or the like) getting *admiſſion* into the *blood* of a *humane body*, will, according to the *degrees* of their *exaſperation*, make their *tranſits* in the bearing down, and mortifying our *animal Spirits*.

Hence thoſe *fiery Serpents* we read of, were probably ſuch whoſe *Fermental principles* was by *exaſperation* wrought to that height, as to become a *venemous Fire*, by whoſe leaſt *entrance* into the *blood* by their *ſting*, or the like, did preſently *mortifie* the *Spirits* of thoſe who were *bitten*, whereby they were *ſuddenly killed*.

And to ſhew, that as the *ſtrength* of our *bodies* depends upon the *energie* of the *animal Spirits*, the product of *vital Fermentation*, according to whoſe remiſs or intenſe *degrees* of *depuration*, *ſublimation*, and *eradiation* in their proper *Channels* the *Nerves*, the *weakneſs* or *vigour*, yea the whole *craſis* of the body *ſubſiſts*, (Diſeaſes generally prevailing upon us from their *various aſſaults* which are made upon theſe in their *original ſource* of production, I mean in the *fermentable juices* of the body) ſo likewiſe the *Spirits* of *venemous animals* (the product alſo of the *Fermentation* peculiar to their *juices*) being by *exaſperation* ſo ſubtiliz'd, as that they are highly *invigorated*, and beyond *imagination Spiritualiz'd* *liz'd*, do by their *ſudden fiery vibrating* motion, (if admitted) make their tranſits *quaſi ictu oculi*, through our *Fermenting juices*, preſently arreſt our *Spirits*, and by *coagulations*, and other manner of *mortifications*, ſuſpends their generation and motion, which being *precipitated* and born *down*, and the future *vibrations* of the *vital Acidum* and *Sulphur* mortified, muſt needs bring on death, which is nothing elſe but a *period* put to the mutual *colliſions* of the *vital principles.*

Where we might ſhew, that the *deleterious properties* of *venemous Animals*, as *Vipers*, *Adders*, *Snakes*, *Scorpions*, &c. reſide not at all in their fleſh, becauſe they may and are frequently *eaten*, not onely without *harm*, but alſo in ſome caſes with *good ſucceſs*, but in their *peculiar Ferments* (conſiſting (according to our ſuppoſition) of *Acidum* and *Sulphur* of their kinds) which being capable of *exaſperations* and *heightenings*, are alſo as lyable to have their *Spirits invigorated*, inſomuch as the more thoſe *animals* are angred (as I may ſay) the *ſtronger* the *Fermentation*, and the more ſubtile the *Spirits* are, yea the more *mortal* their *fire*, which bearing the *character* of their *material principles*, have the foreſaid *ſudden* mortifying influence upon our *vital juices*, and the *Spirits* thereof.

We might alſo ſhew, how thoſe ſorts of

Ferments in their ſtrong *inveterating motions*, do ſometimes fix themſelves upon ſome *peculiar matter*, or *coagulated juice* in their bodies, where the *Ferments* lurk as in a *ſeminary*; and this is the reaſon why that *matter* vomited by ſome ſort of *venemous Scorpions*, (If I miſtake not) called *Gecco*, upon their being *whipt* and *hung* up (thereby having their *Ferments exaſperated*) is uſed by the *Indians* as a *ſpeedy death* to their *malefactors*, by *pricking* the *skin* under one *Nayle* of the *hand*, and *applying* a little quantity thereof *to it*, which immediately thereby getting *entrance* into the *blood*, preſently *ſuſpends* the *Fermentation* thereof, *mortifies* the *Spirits*, killing them *preſently*; yea, at *Macaſſar* a Town in the *Iſland Celebes*, belonging to the *Molucco Iſlands*, there is a ſort of *poyſon* (whether made by the foreſaid *artifice* from *inraged venemous animals* I know not) which the King of that place uſes for *expeditious killing* thoſe he would *diſpatch* out of the *way*, by applying it to any *breach* of the *skin*, it immediately from its *Fermental corroſive poyſon*, not only *kills*, but *burns* the whole *body* into a *corruptive putrilage*; concerning which, and many other things of the like nature, we now for brevity ſake willingly deſiſt to inlarge.

CHAP.

CHAP. VII.

HAving in brief thus ſignified the cauſes of the *Fermentations* in *animals*, to conſiſt in a brief, but ſuitable inteſtine dwellings betwixt the two principles *Acid* and *Sulphur*, which coincide *in puncto vitalo*, according to our *Hypotheſis*, and that their *heat* is immediately thence produced.

In the next place, let us conſider whether the ſame *Hypotheſis* may not hold good in the due explicating the *Phœnomena* in that other *kingdom* of *nature*, I mean the *vegitable*, where (beſides what we have already ſaid) *vegitation* in our account, is no other then a gentle *vibration*, and ſlender *colliſion* of the *Vegitable Acid* & *Sulphur*, from which two principles, put into a *wreſtling motion* in every ſeed, after the looſening its body or husk in the *leſsas terræ*, is begun the vegitable *Fermentation*, which ceaſeth not till the body (ſhap'd according to the *form* of thoſe *minute Types*, wrapt up in the *ſeedlings*) and in ſome obvious to the eye, aſſiſted by good *microſcopes*, is brought in all its *pourtrayings* upon the *viſible Stage* of the *World*.

And from this *Fermentation*, ſet afoot in the very *primordials*, *ſeedlings*, and firſt hewings of *vegitable forms*, are deducable all the *obſervable Phænomena* of *vegitables*; for not onely *vegitation* it ſelf conſiſts in a ſlow-pac'd *motion* of the foreſaid principles, ſet into a ſlender eaſie *Fermentation*, but alſo their *colours*, *ſapours*, *odours*, alſo other *medicinal qualifications*, and their propagation by *Seeds*, and their future *Fermentations*, as of *Corn*, *Grapes*, and *Fruits*, &c. in order to our *Bread* and *Drink*, are referrable to the various *inteſtine wreſtlings* of the inbred *Acid* and *Sulphur*.

Firſt, As to *Vegitation* it ſelf, we have already *hinted*, how its performed by a *ſecret Fermentation* from the inward *combating* of their peculiar *Acids* and *Sulphurs*.

Secondly, What are *Colours* but the *ludicra Sulphuris*? the ſportings of *vegitable Sulphurs*, from whoſe *interweavings* and *coagulations* upon their *genuine acids*, are ſtruck thoſe *beautiful colours* which ſo gratefully ſalute our *Opticks*, and that by making ſuch alterations in the texture of the parts, as to admit thoſe various reflections and refractions of *Light*, and cauſing ſuch mixtures of *Shades* and *Lights*, as lively to repreſent thoſe amiable, and no leſs admirable appearances of *Colours* to our *Eye*.

Thirdly, What are their *Sapours* but the deductions of *Plants* by their peculiar vegitative *Fermentations*, to any equal temperature, whereby they become *pleaſant* or *ungrateful* to the *Palate*, and whereby thoſe that are for *food* become *nutritive*; whoſe *grateful guſt* in all, eſpecially *Fruits* brought on to *maturity*, ſignifie the *ſoft ſweetnings* of their *Acids*, by the ripenings of their *Sulphurs*; whereby they become *fit objects* for the *Ferment* of the *Stomack* to turn into *nutritive juices*, *quod ſapit, nutrit*, is from this ground moſt certainly true.

Fourthly, Again, what are all *odours* of *Vegitables*, but the *efflorescence* of their *Sulphurs* from *vegitative Fermentations*, whereby, from the continual hits and inceſſant touches of the *native acid* upon the *Sulphur*, the *Sulphur* thereby becomes in part ſo *comminuted* and *volatiz'd* by that gentle *Fermentation*, as to paſs off (eſpecially in the more *odorous Plants*) in a ſenſible *apporrhea*, able to ſmite the Noſtrils at a great diſtance; So that Vegetable *odours* are the immediate products of *intrinſick Fermentation*, which by how much the nob'er the *ſpecifick Sulphur* is, and by how much the higher *graduated*, the more gratefully are we *accoſted* by its *odour*, and at the greater diſtance it is *carried*.

Fifthly, How much the *medicinal* properties of *vegetables* depend upon the foreſaid *Fermentation*, will not be unaptly repreſented by obſerving their chief dependance upon their *Sulphurs*: For what is it in moſt *vegetables*

bles that we ſeek after, or that doth the work, but the *Sulphurous* and *Oylie principle*, which is no otherwiſe brought on to *maturity*, but by the *uninterrupted colliſion* and *inward wreſtlings* with its *connate acid*, whereby it ſweetens the *Acid*, is it ſelf *volatiz'd* and *graduated*. and moſt what complicated with a *volatile Salt*, the product thereof.

Sixthly, As to the *propagation* of *vegetables* by *Seeds*, how that alſo is performed by the foreſaid *Fermentation*, will be evident, if we conſider, That as *Fermentation* in *vegetables* begins in a *ſeminal punctum*, wherein is *delineated* all the *organical parts* (if I may ſo ſay) the whole *plant-Embrio*, (being by the great and moſt skilful contriver of *nature*) *epitomiz'd* into a *punctum mechanically* indiviſible, onely diſcoverable to the Eye, in ſome *Seeds*, by the help of good *Glaſſes*, according to the excellent and curious *micro-ſcopical obſervations* of the worthy *Malpigius*. So I ſay it ceaſeth not till it *terminates* in a new *ſeminal punctum*, its ſet afoot in the very firſt motions of *Seed*, and ends not till it have by the ſame *wreſtlings* of *Acid* and *Sulphur*, produced a new *Seed*, or rather a new Cloathing for the *Seed*: nor doth it then ceaſe to be a *Ferment*, onely lies *dormant*, cloſe ſhut up, as in a *Priſon*, in the *husk* of the *Seed*, till it be ſet awork again by being put into a *proper matrix* or *analogous* *moiſture*, and then the *compage* of its body is *looſed*, the Priſon doors are ſet open, and the *Embrio* Captive ſet at liberty: yea, if *Fermentation* of *vegetables* was duely underſtood, and carefully attended, it would never ceaſe to *act*, during the *world*: for if when by *Fermentation* the two *principles* concenters themſelves *in puncto*, ſhaping a new *domicil* (for their retirement a while, till other aſſiſting cauſes, according to the appointment of *God*, conſpire at their due ſeaſons) ſhould then immediately be committed to its proper *matrix*, the *Fermentation* would keep onwards in its pace, which being continually obſerv'd, would never ceaſe to act. But becauſe *God* the great Builder of all things, hath limited the *Fermentations* and *Productions* of all *vegitables* to certain *ſeaſons*, therefore do the *principles* take *ſanctuary* for a time in thoſe *viſible grains* and *husks* we ſee; which *husks*, although to us they ſeem *new* Seed, yet they are but new Cloathings at the beſt, to that *inward* Seed, which ceaſeth not, and from this *Fountain* it was, that *Paracelſus* and *Helmont* truly tell us, that *eſſentiæ rerum non pereunt*.

And indeed we cannot but look upon *Seeds*, or *Seminary principles*, in all things thence *producible*, as *Embrio-Anchorites*, concentred and thruſt up (by the great skilful Builder and Contriver of all things) into ſmall parcells of *matter*, which (at leaſt in ſome) are *mechanically* (I dare not, nor indeed can ſay *Phiſically*) *indiviſible*: Now that theſe *Plant-Embrio's* are ſo minute in moſt, as to eſcape any *mechanical diviſion*, and in ſome ſo *inconſpicuous*, as not to be *diſcernable* by the moſt curious, aſſiſted by the beſt and moſt skilfully contriv'd *Glaſſes*, is very evident to thoſe who are very *inquiſitive* herein: And yet theſe ſo minute points, *mechanically indiviſible* (which is worth our remarking) being put into their proper *matrix*, or having a competent *moiſture* allowed them, do by a ſlow *Fermentative motion*, compitible to all *vegitation*, begin to make *inteſtine colliſions* and inward *wreſtlings* of their inbred *principles* of *Acid* and *Sulphur*, whereby that *little parcel* of *matter*, ſo ſmall as not to be *obvious* (at leaſt in ſome) to the Eye, aſſiſted as aforeſaid, is by the power of its implanted *Ferment*, capable of being *ſplit* and *ſubdivided* into plenty of yet more *minute parts*.

Laſtly, (for at preſent we only deſign *tranſient ſleight touches* upon each) That the *Fermentations* of *vegetables*, as of *Corn*, *Grapes*, *Fruits*, &c. in order to the preparing our *Bread* and *Drink*, depends upon the foreſaid *colliſions* and *inward ſtruglings* of the two *principles Acid* and *Sulphur*, is hence evident, becauſe if the *Acidum* of *Paſte*, *Muſt*, *Wurt*, or the like *Fer-*

mentable Liquors, be by the addition of any other thing *precipitated*, *altered*, or *mortified*, then will thoſe *Liquors* never *Ferment*. Thus if *quick-lime*, *coral*, *Crabs Eyes*, or any ſort of *fixt livial Alcalies*, be added thereto, either before it begin, will prevent, or if while *Fermenting*, will cauſe the *Fermentation* to ceaſe.

Ferments are ſo obvious in the preparing our *Bread* and *Drink*, as that uſually *Fermentation*, (through the defect of the right underſtanding the *nature* and due *improvement* thereof) hath been *imputed* to few other *things*. The brisk *efferveſcence* of *Wines*, which work without any *additional Ferments*, owe their *Fermentative motion* to no other, then to the *quick ſtruglings*, and inbred *colliſions* of their *native Acid* and *Sulphur*; a great part of whoſe *ſuperfluous Acidum* and *Sulphur*, complicated with a *volatile Salt*, together with other *Heterogenities*, are, during *Fermentation*, rejected and precipitated in the form of *Tartar* (of which more in our *Halologia*) The reſt from a *genuine wreſtling* of the *principles* compoſe an equal *temper*, and generous *potable Liquor*, viz. *Wine*, the nobleſt of *vegetable Fermentable juices*. The like may be ſaid of all other *vegitable Fermentative Liquors*, ſuch as are *Ale*, *Beer*, *Syder*, &c.

If the *efferueſcence* of *Wines* prove ſtrong, either from the too *brisk aſſaults* of the *inbred*

Acidum and *Sulphur*, (as ſometimes happens in *new Wines*) or from the *reimbibition* of the formerly depoſited *Tartar*, or rejected *rich Lee* or *Fæces*, (both well *Saturate* with the foreſaid principles) or from too great *agitation*, or *immoderate warmth*, or ſome *heterogeneous Acids*, as of different ſort of *Grapes* preſt into one *muſtum*, or from the addition of *Mercury ſublimate* (wherewith ſometimes it is *adulterated*) or the like; if I ſay, from any of the foreſaid ways, *Wines* be ſet into a Fermentative motion *de novo*, and put into a high *efferveſcence*, the remedy chiefly conſiſts, either in the *racking* it *oft*, whereby the *contracted fervour* is to be *abated*, and *future imbibitions* are to be *prevented*; or by *precipitations* of the foreſaid *Tartarous particles*, or *extraneous bodies*, which is to be performed by affuſion of plenty of *Milk*, or ſuch ſort of *Liquors*; by which, not only ſuch kind of *precipitations* are well performed, but alſo doth help to *allay* thoſe *Fermentations* too much exalted from *agitation* by *Carriage*; or which *happens* from *immoderate heat*, by attempering and ſoftening inordinate *exæſtuations*.

And as this is to be done in *Wines*, whoſe *principles* are *too active*; ſo on the contrary, in the *great impoveriſhment* of *Wines* from the *depreſſed ſtate* of the *principles*, ſomewhat of a like *Ferment* ſhould be added, ſuch, I mean, as may not only *acuate* the *dormant principles*, but alſo may *inſpire* a new ſort of *Ferment*, *congenial* to the former, of which kind, is a *well impregnated Tartar*, or *ſtong Lee* to be put thereto, or a *Fermental Syrup* compos'd from a *generous Wine*, *Sugar*, or ſome *Aromaticks*, to bring on a freſh *Fermentation*, or a little *Fermenting Wine*, freſhly working upon its *Lees*; if in *Ale*, which wants a due *Fermentation*, either a little freſh *Ferment*, I mean the *flores Cereviſiæ*, call'd *Yeſt* or *Barn*, or a little new working *Ale* is to be added, eſpecially after a cohobation of *freſh Malt*, or upon *Malt* once by *infuſion* extracted; or ſome duſt of *Malt*, and ſome *ſliced Ginger*; or *Eggs* well beat; but to return:

Yet ſome of theſe will not eaſily Ferment *per ſe*, but require an *additional Ferment* to excite their *implanted Acidum* and *Sulphur*, into a brisk motion or ſtrugling, which we call *Fermentation*. Thus in the making *Ale* or *Beer*, from the infuſion or juice of *Malt*, a congenial *Ferment*, viz. *Yeſt* or *Barn* (which is *flos Cereviſiæ*, or the ſeedling of its *Fermentation*, able from its *Symbolical principle*, to propagate *ad infinitum*, of which more elſewhere) is to be added, to rouze up the like *principles* of *Acid* and *Sulphur*, in the foreſaid *juice*, to a *Fermentative motion*.

Thus alſo in the preparing the *potable Liquor* from *Sugar* (which if done with *Birch-water*, makes it the more *medicinal*) a *Ferment* of *Yeſt*, or the like, is to be added, which ſets the foreſaid *principles* in the *Sugar*, into a *Fermental motion*, whereby it becomes a good *potable Liquor*, bearing ſome reſemblance to *Wine*: Now that there is *Acidum* and *Sulphur* in *Sugars*, *Grapes*, *Apples*, *Berries*, *Cherries*, and other *Fruits* and *Grains*, is very *obvious*: Firſt, As to their *Acids*, thoſe are plainly diſcoverable both by the *facile degenerating* of *Liquors* or *Juices* hence made into *Acids* or *Vinegars*, if I may ſo call them; thus *Sugar-Canes*, laid by in *Troughs*, becomes very *Acid*, and ſo of the reſt: As alſo by their *diſtillation*, as appears in the *diſtillation* of the *Floors* of *Wheat*, *Wrye*, &c. which give an *acid Spirit*; ſo all *Fruits*, *Sugars*, *Honey*, &c. which by *Fermentation* are capable of becoming *potable Liquors*, by diſtillation yield an *acidum*, witneſs the *acid Spirit* of *Sugar*, *Wheat*, *Honey*, &c. Your Bread diſtilled yields an *acid Liquor*, chiefly from the added *Ferment*, which ſets the *Acidum* of the *Corn* more at liberty; from both which proceeds that *acid menſtruum* taken notice of by the honourable *Boyle*, which will draw a *tincture* from *Stybium*, as we have try'd.

And as to *Sulphurs*, they are demonſtrable to be in all the foreſaid *Fruits*, *Sugars*, *Grains*, &

&c. Firſt, By their *Vinegars*, in all which lurk an *Oyle*, ſeparable by *Art* two or three ways, as we ſhew in our *Lithologia* and *Halologia:* For when the *Acid* prevails, it diſſolves the *Sulphur per minima*, and hides it in it ſelf, under the mask of an *Acetum*. 2ly. By *Diſtillation*, as when urg'd by ſtreſs of *Fire*, they give beſides their *acid Spirit*, an *Oyle*, which from the forcible *actings* of the *Acid* upon the *Sulphur*, and ſome *terreſtrial parts*, by the violence of *Fire* makes it become *Empyrhumatical*, (as in our *Halologia* we further inlarge.) 3ly. By *Putrifaction* and *Diſtillation* they give an *Oyle*. 4ly. By *Fermentation* and *Diſtillation*, whereby they become *vinous Spirits*, whoſe *Sulphur* is diſcernable from their *flagrablity*. And Laſtly, (to omit what might probably be done in order to the ſeparating genuine *Oyles* from ſome of them by bare *Diſtillations* in *water*) by their evaperations of their *juices*, and extractions by *vinous* Spirits, whereby their *tinctures* are drawn, which are nothing elſe but *ſpecimens* of their *Sulphurs*.

As to *Corn*, ſuppoſe *Wheat*, or any other *Grain*, the ſame principles of *Fermentation* are evident; for when wrought into a *maſſe* with *water*, and the addition of a little vegetable *Ferment*, ſuppoſe *Yeſt*; this by the *congruity* and *congenialneſs* of its parts to the *ſimiler Ferments* implanted in that *Grain*, ſets it into to motion; for all additional *Ferments* do no more but *excite* the *principles* of *Fermentation*, native to the body, or Liquor to be *Fermented*: for neither *Yeſt* put to water, nor *Old Leaven* put to powder of Stone, mixt with water, will cauſe either of them to work for want of *Symbolical principles*.

Yet this laſt Paragraph we are to ballance with this following *conſideration*, and that is to *illuſtrate* the reaſon why *Corn* (for inſtance *Wheat*) ſprouted by overmuch *wet* in the reaping, or *moiſture* by bad laying up, will not make good *Bread*, at leaſt, other ſorts of Table Food, becauſe hereby the *vegetative principles* of *Acid* and *Sulphur* are excited, which ſhould either go on in order to propagation by *vegetation* or *germination*, or that deſign of *nature* being perverted by *artificial malting*, might thence be uſed for preparing a *Fermentable*, and afterwards *potable Liquor*: but being imploy'd for other purpoſes, from the *activity* of the *principles*, already ſet into a vegitative *Fermental motion*, as ſoon as they feel the *Heat* retaining their vegitative ſprouting *motion*, break the Priſon doors; and in ſhort, if the *heat* was anſwerable, would *Sprout* and *Grow*; but becauſe the *heat* is ſtronger then is required for ſuch purpoſes, it onely makes the Maſs *Fat*, or become more *Florid*; and thence it is that ſuch *paſte* bakes not ſolid and firm, but falls and runs in the Oven, as being more fit for making *Malt* then *Bread*, or other ſuch *Food.*

CHAP. VIII.

NOw that there is ſome gentle warmth in all *vegetable Fermentations*, undiſcernable to our ſenſes, is apparent, becauſe the ſame *principles* of *Fermentation* being invigorated in their brisk *inteſtine duellings*, may become ſenſibly hot, witneſs the heat of *ſteep'd Barley*, laid on a heap in order to *Malting*, which if neglected for want of turning and ventilation by *Air*, will become ſo *hot*, as one cannot induce his hand long in it: Yea, and from the ſame *principles*, yet heightned in their *inward Colliſions*, may an actual burning Fire be produced: Witneſs *Corn* wet, laid in *heaps* in Chambers if neglected, will take *Fire:* Alſo *Mows* of *Corn* laid up too *moiſt* and *cloſe*, have been *Fired.* So likewiſe a *Rick* of *Hay* is ſometimes *burnt* to Aſhes, from the *violent* and *furious Fermentations* of its *principles*, and that from its *moiſtneſs* and *cloſeneſs*, ſetting its *principles* of *Acids* and *Sulphur* into a *violent motion*, ſo as to break forth into *actual Flame.*

Not to ſay here how *Acids* are ſweetened by *Sulphurs*, and ſometimes *coagulate* into a neutral body: For although all *Fermentation* is certainly (at leaſt according to our *Hypotheſis*) caus d from the *Colliſions* and inward *combatings* of *Acids* and *Sulphurs* in the production of things: yet as *Acids* amongſt bodies (as I have before, and may more largely hereafter ſhew) *differ* amongſt themſelves, ſo they make *different aſſaults*, and are variouſly reacted by *Sulphurs*, whence both, by their mutual *actions*, undergo various *changes* and different modifications amongſt bodies in their *transformations*.

And as ſome *Acids* ferment with their *Sulphurs* in an inward wreſtling, the *Sulphurs* afterwards as they *predominate* upon the wheel of *operation*, ſoftening, ſweetening, and ripening their *Acids*, making gentle *coagulations* in their *naturations*, both amongſt *animals*, *vegitables*, yea, and *Minerals* too (although more obvious in the two former) ſo likewiſe ſome *Sulphurs* ferment with ſome *Acids*, while with others they combine in a natural texture, to confirm which we ſhall onely (becauſe in haſt) give this ſingle *mechanical example*, which ſhall be in *Mercury* or *Quick-ſilver*, to which if a *Spirit* of *Nitre* or *Aqua fortis* be added, the mixture preſently *ferments* from the *colliſion* of the *Sulphur* in the *Mercury*, and the *Acids* in the *MenStruum*, whereby the compage there is broken from the intimate commixture of the *Sulphur* with its *Mercurial* parts, whence a *ſolution* of the whole: But if in lieu of that *corroſive Menſtruum*, the dry Salts (of which that *Menſtruum* by a *colliquating fluor* with their inbred *Sulphurs* by *Fire* is made) be mixed and ſublimed together, there happens no *Fermentation*, but ariſe in a *corroſive ſublimate*; to which, if ſuch a due proportion of freſh *Mercury* be added and re-ſublim'd, they coagulate and ſweeten each other into a *ſolid concretion* of a neutral texture, which is that trite preparation we call *Mercurius dulcis*, in which the *acid Salts* of *Vitriol* and common Salt is ſo dulcified by their interweavings with the *Sulphur* of the *Quick-ſilver*, as that it will not coagulate *Milk*, and ſo becomes (being well prepared) a very harmleſs and innocent *Medicine*: whilſt the ſame *ſublimate* (thus *ſweetened* by the *Sulphur* of its *Mercury* freſhly added) if therewith *Antimony* in lieu of *Quick-ſilver* be mixed, the ſame *acid Salts*, meeting with a different *Sulphur* in *Antimony* then in *Mercury*, falls into a *colliquation* and fretting *Fermentation*, cauſing a great *heat*, and becomes a ſtrong corroſive.

And as from the *difference* of *Acids* amongſt themſelves, and their various aſſaults upon their *Sulphurs*, cauſe various changes in the *geueſis* and *transformatiors* of Bodies, both in the texture of *Liquors*, and the *concretions* of Bodies: So from various modes of aggreſſion of our *principles*, juſtleing differently, according to various applications, are produc'd varieties of *effects*, which are diſcoverable from the difference of *Spirits* thence ſeparable, which in ſome (at leaſt upon rectification) ſmite our Organs of *ſenſe* with great variety, as will appear theſe following ways: Thus, Firſt, If the *principles* are ſet awork in the *ſeminals* of things, in a generative way, as ſuppoſe in *Vegetation*, here the *principles* by an *evolution*, expand themſelves in a ſlow but genuine *Fermentation*, whoſe effects (I mean their *Spirits*) moſt what guiſe themſelves in the *minute effluvia* of *odours*, eſpecially in *odorous Plants*, and that chiefly in the opening of the *Flower* (though in many through the whole plant) when the *Sulphur* is by circulatiou (as I may ſay) ſo *ſubliliz'd* by its connate *acid*, as to paſs off in a *ſubtile Steam*, for hereby the *acid* not onely ſtrikes the *colour*, (according to the varieties of *Acids* acting upon their proper *Sulphur*) but alſo cauſeth an *expanſion* and *emanation* of ſubtile parts. Secondly, If this *Fermentative Vegetation* be carryed on to the maturation of *Fruits*, and in their *Juices* the foreſaid *principles* be again ſet awork, they then make different aſſaults, combining in other manner of *colliſions* then before, as is evident from the *vinous Spirits* thence eaſily ſeparable, which partake much of the *volatiz'd Sulphur*. Thirdly, Thus if during *Fermentation*, any quantity of a plant (ſuppoſe *Wormwood, Mugwort, Tanſey*, &c.) ſhould be gathered and laid together in heaps: Here the *principles* make new and different *colliſions* then before, making retrograde *motions*, which tend to a *putredneſs* of the *Plants*, the product of which *Fermentation* is a volatile *Urinous Spirit*, as appears by Diſtillation thereof: which is ſo ſtrong in ſome *Plants*, as that it doth very diſcernable *ferire nares*, as I have felt in the *Glaſtum* or *Wood*, prepared by that artifice of putrefactive *Fermentation*, yea, the workers thereof told me, that when after a *previous preparation* (by Grinding and expoſing to the Air in *Cakes*) they are laid in *heaps*, the *Fermentation* is ſo very ſtrong, as the *Urinous Spirits* thence iſſuing, are ſcarce tolerable to thoſe that are near it: which laſt named *Spirits* are as much a product of that ſort of *Fermentation*, as the two former are of theirs; and therefore as we are not to gueſs at the quantity of *vinous Spirits*, ſeparable by that *Fermentation* peculiar to thoſe *Fermental juices*, as if *pre-exiſtent*; nor of Odours in *Plants*, as aforehand, in their *minute ſeedlings* before the openings of thoſe powers by their own vegitative *Fermentation*: ſo neither indeed ought we to eſteem thoſe *vinous Spirits*, pre-exiſtent in the *Plants* before *putrefaction.*

And as the different modes of the *principles*, *aggreſſions*, and *colliſions*, cauſe various ſorts of *Fermentations*, and different kinds of *Spirits*, thence ſeparable in the *Vegital*; ſo likewiſe with ſome variation, they do the like in the *animal Family*, I mean, that according to the various methods of the *principles* mutual combatings, different ſorts of *Spirits* thence *reſult*: thus from the inteſtine *ſtruglings* betwixt the *native Acidum* of the Stomack, and the *Sulphur* in the Food begun in the Stomack, carried on by the *intermediate Ferments*, and compleated in the blood, are produced thoſe ſorts of *Spirits* we call *animal.*

Thus from the ſame *principles* acting upon each other in a retrograde motion, which is that we vulgarly call *putrefaction*, are all other ſorts produc'd; and ſo of the reſt, which we ſhall not now enlarge upon; and as to what reſults from *mineral Fermentation*, we have elſewhere diſcourſt.

That *moiſture* or *water* (the former of which is but the latter rarified) is abſolutely neceſſary, both to the ſetting the *principles* of *Fermentation* awork, as alſo to the keeping them afoot even in all ſuch *motions*, from the very loweſt degree of *vegetable Fermentation*, to the higheſt of *actual flagration*, is evident in moſt things throughout the ſeries of *natures triplicity*; thus Vegitables neceſſarily require *moiſture*, not onely to ſet, but alſo to keep their *principles* of *Fermentation* in a conſtant *Spring*. Thus the *Ferments* of our Stomacks do really need the pouring down of *Water*, *Wine*, *Ale*, *Beer*, or other *potable Liquors*, for the perpetuating and invigorating their *active principles*.

And hence, for ought we know, may be the reaſon why a *Glaſs* of *Water*, taken after a plentiful *repaſt*, is found to help the *digeſtion*, by ſetting the *Fermentation* awork, which otherwiſe, by the glut of *Food* might be interrupted, and that too by diluting the aſſum'd *aliment*, and ſo ſetting the *Acidum* of the Stomack and *Sulphur* of the food into a mutual *colliſion*, even as a little water poured to the thick *Oyle* of *Vitriol*, by diluting, ſets the inward *principles* of *Acidum* and *Sulphur* into a *Fermentation*, thence producing a conſiderable *heat*, as we elſewhere further treat.

So likewiſe do the *principles* of *mineral Ferments*, in their ſource no leſs require the continual afflux of *Water*, in order to the heightening their *heat*, and making of *hot Baths*: Thus alſo *Braſs Lumps* (which are a ſort of *vitriolin marcaſite*) laid in heaps, do from the *moiſture* of the Air, or *ſprinkling* of *water*, ſuffer their *principles* of *Acid* and *Sulphur*, by their mutual *colliſions*, to be ſet awork, which are *invigorated* to that height, as to riſe to an actual *flagration*.

The ſame will *Metal-Coals*, *Mines* of *Tin-Glaſs*, *Alom*, &c. do, and that from the identity of cauſes with the former: So likewiſe *moiſt Hay*, *Corn* in Green or Moiſt Sheafs, *Corn Steeped* or otherwiſe *Moiſtened*, do all of them from the ſame heightening of the *action* of their *principles* by moiſture, conceive *heat*, yea take *fire* too, as is aboveſaid. So that wherever *Fermentation* happens, and that there is plenty of *moiſture* or *water*, there the *Fermentation* is conſiderably heightened, as may be illuſtrated by all the foreſaid inſtances. And wherever there is *heat*, proceeding from the ſame *principles* of *Acidum* and *Sulphur*, if theſe by the addition of *moiſture* become ſufficiently *intended*, will certainly cauſe *Fire*.

Yea perhaps *fire* it ſelf, I mean, the *culinary* made up, and fed with *combuſtible concretes*, doth as neceſſarily require a *moiſture* in the *Air*, to the performing its quick rapid *Fermentation* of *ignition* and *flagration*, ſo as to make the *principles liquid* in the very act of *flagration*, yea that *mineral corroſive Fires* do require the addition of *moiſture* or *water*, upon no other account, then for the *diſſolving* and putting into *Fermentation*, their corroſive *Acids* and *Sulphurs*, is evident, not only in the *Oyle* of *Vitriol*, but alſo in the *Stigian waters*, viz. *Spirit* of *Nitre*, *Aqua fortis*, and *Aqua regia*, the two former of which being the ſame thing, as made from the ſame *principles* of *Acid* and *Sulphur*, (diſſolv'd by the help of *fire* in *water*, as we further declare in our *Halologia*) all which are *corroding menſtrua's*, or liquid burning fretting *fires*, which while in the form of *dry Salts* or *Sulphurs* ſeparated, are not at all apt to make ſuch *corroſions* of *Metals*, *Minera's*, &c.

For according to our *Hypotheſis*, *corroſive menſtrua*, are not made from *Salts* in *fluor*, nor are they bare *acetous Liquors*, or *Saline particles* driven by force of *fire*, from the *imbraces* of their own *Earth*, as the learned Dr. *Willis* would have them, but are an *Acid* and *Sulphur* brought over in a *Liquid form* : That they are all *Acids* , needs no proof; and that they have all *Sulphurs*, may very eaſily be made to appear, by the *reſinous*, *oylie*, or other *Sulphurous* ſeparations to be made from all of them, even from the leaneſt, I mean *diſtilled Vinegar*, (as we demonſtrate in our *Lythologia Phyſica*, and *Halologia*) ſo that *Acidum* and *Sulphur* by ſtreſs of *Fire*, raiſing up ſome *Liquid* or *watery parts*, fall into a *fluor*, and thereby become *corroſive menſtrua*: For *mineral Salts* never become *corroſives*, till their

Sulphurs and *Acids* colliquate, and that they do, either by *diſtillation* from ſtreſs of *fire*, the *acidum* of the *fire* aſſiſting their *colliquations*, as is evident in the making of the *Stygian*, and other *corroſive menſtrua*, or by *Fermentation*, as appears in the mixture of *Mercury ſublimate*, and *crude Antimony*, or *regulus* of *Antimony*, where the *acidum* of the *Salts*, catch hold of the *Sulphur* in the *crude* or *reguline Antimony*, and cauſe a *Fermentation*, colliquating together, or rather by their *colliquations*, cauſe a *Fermentation*, which you will; for wee ſee upon the *Fermentation*, the maſs of *Salts* and *Antimony* flow together, appearing in a liquid, although *thick form*, which *Colliquation* and *Fermentation* is perform'd, without the leaſt *ſpecimen* of any *alcali*, or *quid alcali analogum*: to which many ingenious perſons (for want of a true *Baſis* and right *Ariadnes Thred* to extricate them from difficulties) are driven to take Shelter in the ſolving theſe and the like *Phænomena*.

And not onely *corroſives*, but *cauſticks* alſo, we ſuppoſe (according to our *Hypotheſis*) to conſiſt both of them chiefly in the *vigour* of *Acids*, raiſed to the height of *Fermentation*, and to differ onely in this, that *cauſticks* are made from the *acidum* of *Fire*, and that either as in its own *rapid motion* of *Fermentation*, happening betwixt the *Acidum* and phur of the *combuſtible concrete*, or as its *Acidum* is fixt *inter cremandum* upon ſuch ſort of bodies as can graſp hold of, and detain it in its *intrails*, of which are all ſorts of *fixt Alcalies* (as they are call'd) *minium*, *calx vivæ*, &c. whereas *Corroſives* are made from the *acids* of *Minerals*, complicated with their *Sulphurs*, and heightened by *Fire*, which by the *medium* of an *ingeint moiſture*, or by a *colliquation* betwixt themſelves, become *liquid corroſive Menſtrua*; of which, more elſewhere: And of whoſe manner of *workings* in the ſolution of *Metals*, we have above given a ſhort account, according to our depoſited *Theſis*.

Yea, and that ſome *Acids* and *Sulphurs* will *colliqueſcere*, even without the help of *Fire* in *diſtillation*; and in that *colliquation* will cauſe a *ſtrong Fermentation* and *intenſe heat*, is evident from the mixture of *Antimony*, or the *regulus* of *Antimony* and *mercury ſublimate*, with dry powders, will melt (being mixed) as if fuſed in a *crucible*.

We ſhall not here ſay, how by the *Fermentations* of our foreſaid *principles*, all *vegetable* and *animal concretes*, (for the texture of whoſe bodies, *water*, as a *material principle*, is abſolutely requiſite, and which is wrought up into thoſe bodies in their *natural generation*) are *continually*, by a conſtant *wheeling* off, after a little *rotation* in the *Air*, in the great *capitellum* of the *Amoſphere*, turn'd into *water* again, or into *watery vapours*, which are but *water rarified*, and how that *watery vapour* is as one ſpring in the *Air*, for the ſetting all other *Fermentations* awork; not onely uſeful towards the *actual flagration* of *combuſtable matter*, maintaining thereby the great *round* and *circulation* of *generations* and *reductions* of all *bodies*. But alſo from the ſame *moiſture* in the *Air*, carried thither in the great *circulation*, and fed by inceſſant *ſubterraneal ſteams*, ariſing eſpecially from Springy and other watery places, which whether in the form of *Dews*, helps to feed *Corn* and *Graſs*, kept back by long *droughts*, or whether wrapt up more inviſibly in the Air, doth yet reach ſome of the *tender veins* of other *vegetables*, or uniteth with the ſlender *fibers* of their *roots*, plac'd in *Sandy*, *Gritty*, or other *barren Ground*, and thereby either way by a ſort of *filtration*, is communicated to their *Juices*, whence ſuch *Plants* (which otherwiſe could ſcarce be thought to receive any ſufficient ſupply from ſuch *barren Soils*) admit of a competent ſtock of *moiſture*, able to carry on their *vegetative Fermentation*, whereby they grow and thrive well: And hence it is, that *Orpin*, and ſeveral other *Plants*, onely ſet in Sand, and ſometimes ſprinkled with *water*, doth from the foreſaid *moiſture* in the *Air*, vegetate and like well.

Nor here to ſhew how *Air*, after a double manner, *contributes* towards the *Fermentation* both of *animals* and *vegetables:* yea, towards the producing the higheſt of *Fermentation*, *Fire*; nor ſhall we take time here to inſiſt upon *water*, as the true *material principle*, indiſpenſibly neceſſary for the production of all *bodies*, the want of which in the *grand circulation* of *nature*, bring on a *conſuming drought* in all *bodies*, whereby thoſe *concretes* (whoſe *natives* the *principles* are) wither and dye, becauſe their *principles* of *Acidum* and *Sulphur*, having not whereon to work, and model *bodies* with, deſert them, taking *wing* into their own *æther*, leaving their former *receptacles* to pine away in a continual *maraſme*, and unavoidable *tabers*; Nor to ſhew, how *water* is indeed as eſſentially requiſite, *materiæ gratia* for *natural*, as Stone and Wood, are for *artificial fabricks*; whilſt the *active principles* of of *Acidum* and *Sulphur*, are the inward *artificers*, the implanted *fabers*, yea the hidden *limners*, who by the manuduction of *Seeds*, hews out *forms*, *ſhapes*, and draws forth the *lineaments* and *portraitures* of all things, anſwering *ad vivum* (from the unerring rules of *nature*) their beautiful *antitypes*, inviſibly coucht in the *initials* of all *bodies:* But (now ſtudying brevity) ſhall leave them to a further *diſcourſe*.

From what is premiſed concerning this our Doctrine of *Fermentation*, how it is *performed* in all *vegetation*, as being the loweſt orb (in the whole round world of *nature*) it moves in, and yet is the true beginings of all *fire* in *bodies*; and that the moſt *violent* of *fires*, is no other then this *Fermentation* in the moſt rapid manner; the *principles* furiouſly driving upon each other, will be evident, and very obvious from this following *mechanical experiment*. Take the ſubtile æthereal *Spirit* of *Venice Turpentine* four Ounces, (which is nothing elſe but the *Sulphur* of that *vegetable reſinous gumm*, comminuted and ſubtiliz'd by gentle *diſtillation*, and intimately marryed to a *defæcate implanted acid*) as alſo *Aqua fortis* ſix Ounces, both recently drawn, mix them together in a *Glaſs-Viol*, and they will preſently fall into a *furious Fermentation*, which will ariſe to tha height, as *actually* amongſt the *thick cloud* of fumes to *burn* and *blaze out* of, and abov the *Orifice* of the Glaſs in a *viſible flame*.

Now what is *obſervable* in this *Fire*, thus by the foreſaid *mechanick* produced, and whenc the cauſes, the ſame may truly (we think) be ſaid of all *other fires* in *combuſtable concretes*: for here the *Acidum* in the *Aqua fortis* (lately made) is very ſtrong, cloſeth with the *Aci* in the *Spirit* of *Turpentine*, immediately ſet upon the *Sulphur* in the ſame *vegetable Oyli*

Liquor, which *Sulphur* being *congenial* (as *Sulphurs* uſually are to *each other*) to that in the *Aqua fortis*, increaſeth in its *vigour*, whereby both the *Acid* and the *Sulphur*, even in both *Liquors* become *fortified*, and forthwith fall into an *inteſtine Colliſion*, whence the *Fermentation begins*, which being by the *purity* and *ſincerity* of the *principles*, more and more *heightened* and *invigorated*, (having no *heterogeneous* matter to interrupt their inward duellings) at length ariſe to that degree, as to *colliquate* into an *actual fluid flame*, which is the very ſame cauſe we elſewhere *aſſign* to to the production of all uſual *Fire* in *combuſtable concretes*, only with this difference, that in ſuch *flagrations*, conceived from the immediate *conflicts* of the *principles*, there are not, as I ſaid, thoſe *heterogenities* interwoven, as in other *combuſtable concretes*, ſet into that *rapid motion* by *kindling* or *firing*.

Thus I ſay theſe *actual flagrations*, whether from the furious aſſaults of *fiery acido-Sulphurous Liquors*, as is apparent from the foreſaid *mechanical experiment*, or from *Acids* and *Sulphurs*, ſet into *inteſtine conflicts* in *combuſtable concretes*, as is evident in all uſual *Fire*, is no other then our foreſaid *Fermentation* in a moſt *violent hurry*, the *principles* acting *furiouſly* upon each other; while other *ſlower Fires* are maintain'd by ſleighter, and more *gentle touches* of the ſame *principles*. Hence methinks, when I behold the *varieties* of *Vegetables*, I cannot but eſteem them as ſo many *igniculi*, little *Fires*, ſhewing their various luſtre in their *peculiar colours*.

Yea to me the whole *appearance* of *nature* in the *concretions* of moſt *bodies* throughout the *triplicity* of her *dominions* (ſome *Petrificks*, and ſuch like *anomolous* productions *excepted*) is nothing elſe but ſo many *Lamps* burning in *water*, each of them diſtinguiſhing a *parcel* thereof, into this or the other *viſible figuration* which we commonly call *bodies* or *concretes*, ſo that the *Philoſophers ignis aqua*, I mean, both their *Mercury*, and the *grand* Solvent the *Alchaheſt*, in which the *ignis Sophorum* is *artificially implanted* in the *mercurial* or *watery juices*, is but an *Epitome* of what *nature* in the great volume of the *World*, ſets down in *Folio*; yea, is no otherwiſe preparable by art, then what (to a *Philoſophick* eye) *nature* is conſtantly *performing* in its great orb of *productions*.

And as each Body carries its *central Fire* ſhut up in its *Boſom*, expanded or blown up by the *evolution* of its *ſeminals*, depending upon the implanted active *principles* of *Fermentation*; ſo likewiſe that adventitious *heat*, which helps to foſter *Fermentation*, (in ſuch *juices* or *concretions*, where the *active principles* ſeem to be *immur'd*, in the weighty bulk of *terreſtrial*

ſtrial parts) ought in its degree to be gentle, ſoft, and ſymbolical to the *Fermentative principles :* which if it exceed, in lieu of cheriſhing, diſſipates the *nimble agents*, and ſpoils the act of *Fermentation*, and this is evident, not onely in the *concretions* and *maturations* of *Fruits*, but in the *Fermentations* of *potable Liquors.*

Thus as to the Firſt, *Fruits* while upon the *Trees*, by the help of the *Sun*, have their *vegetative Fermentations* compleated by the *Sulphurs*, ſweetening and maturating their *Acids*, the like is done (though nothing nigh ſo well) in *Fruits* taken off the *Trees* before they be ripe, and laid by in *Straw*, *Hay*, or the like, whereby the *warmth* of the *Air*, there formerly begun *Fermentation*, is in ſome *meaſure* carryed on to *maturation :* whereas, if expoſed to a more *warmth*, or a greater degree of *heat*, if done in Water, they are *Codled*; if before the Fire, they are *Roaſted :* In both which, although ſomewhat *ſweetened* from what they were, yet are far ſhort of the *pleaſant guſt* and *delicate colour* they arrive at, by their more natural and gentle *maturating heat.*

Thus if any *Grain*, ſuppoſe *Barley*, *&c.* be *ſteeped*, and afterwards laid in *heaps* till it contract a *ſpontaneous heat :* this very *heat* tranſcending that which is *peculiar* to its own *vegetative Fermentation* ſuſpends, or rather indeed *perverts* the intention of *nature*, whereby it will never ſo vegetate afterwards, as to go on to a *propagation* by *Seed*, but onely if permitted (by neglect of turning) will ſhoot forth a *ſpurious branch*, call'd vulgarly an *Acreſpire*.

Thus as to the laſt, *Fermentative Liquors*, if they have any other *heat* but what reſults from the *colliſions* of their own active *principles*, or at leaſt in degree is *congenial* thereto, then the intention of *nature* is perverted by the *diſſipations* of the *principles* of *Fermentation*, or at leaſt, by the graduations of the *Acid* above the *Sulphur*, as appears in heating the *Fermentative Liquor* too much, or in putting it up *too warm* in the *Veſſels* : the like happens (I mean a *diſſipation* of the *Fermentative agents*, or an *exorbitancy* of the *Acidum*) in *hot ſeaſons*, or with the *percuſſions* of the *Air* by the noiſe of *Guns* or *Thunder*, or from *inſolation*, or the like ; In all which the *craſis* of *Fermentable Liquors* are perverted, and the *Acidum* by overpowering the *Sulphur*, grows exorbitant, ſubverting the temperature of the whole.

CHAP.

CHAP. IX.

HAving thus ſleightly (for brevities ſake) run through the reaſons and cauſes of *Fermentation*, from the loweſt to the higheſt degree thereof, in all *natural productions* throughout the threefold *kingdom* of *Nature*, and ſhewed thoſe from the *genuine cauſes* and *natural principles*, to be the *fountain* of *Heat* in and amongſt *bodies* : Now come we to conſider of ſome other *ſorts* of *Heat*, that ſeem to ariſe either from other manner of *Fermentations*, or from other *cauſes* : of which are all *Fermentations* or *Ebullitions* made betwixt *Acids* and all kinds of *Alcalies*, whether *lixivial* or *alcalizate*, *fixed* or *volatile* ; the *Fermentation* and *Heat* obvious in *quicklime*, made by the *affuſion* of *water*, heat alſo caus'd from the *colliſion* and *attrition* of ſolid bodies. For indeed, from a due *examination* I find, there is no *Heat* produc'd amongſt *bodies* (I mean from their own *inteſtine principles*) what ſort ſoever it be, but what is *referable* of one of theſe two, *viz.* either *Acids* and *Sulphurs*, or to *Acids* and *Alcalies* : The firſt is the *natural cauſe* of *Heat* as thence ſpringing from its *genuine ſource*, which admits of degrees even to *actual flagration* :

tion: The other is *artificial*, and never arrives to the height of the former.

I found therefore upon due conſideration, that the foreſaid *Fermentations* and *Heat* reckoned amongſt thoſe which ariſe betwixt *Acids*, and ſome ſorts of *Alcalies*, might be ſolv'd from one of theſe two *cauſes*, *viz.* either from our depoſited *principles* of *Acid* and *Sulphur*, or from a *mutual fretting* betwixt *Acids* and *urinous Spirits*: Thus we ſuppoſe (and elſewhere in our *Lithologio Phyſica* illuſtrate) in all *Petrifick* concretions, ſomewhat of a *Sulphurous principle* lockt up in the ſtrickt texture of the *petrifying native Alcaly*; which when an *acid menſtruum* comes to *terebrate*, finding the *Sulphur* its proper object, cloſeth therewith; and from their *mutual ſtruglings*, happens the ſolution of the *body*; thence proceeds the *Ebullition*, and conſequently in ſome (where it is ſtrong) *Warmth*: For we ſuppoſe a *Sulphur* or *Sulphurous principle*, to be as a *cement*, to bind up the *petrifick Alcali* in all or moſt of *ſtony concretions*.

Thus alſo we ſuppoſe in all *fixt lixivial Alcalies*, (or *fixt Salts* as they are vulgarly called) a *Sulphurous principle*, to be cloſe ſhut up in the texture thereof; and that every *fixt lixivial Alcali*, is a new compage of the ſame *præ-exiſtent principles*, produc'd and bound up by the *Acidum* of *Fire*, where the *Acidum* and *Sulphur* are ſo interwoven with a *volatile urinous Spirit* or *Salt*, as that by force of *Fire* they do *colliqueſcere*, melt down into a body diſſolvable *per deliquium*, which is generally eſteemed a *ſimple Salt*, but having diſcourſt largely thereof in our *Halologia*, ſhall now wave it, and onely ſay, that theſe fixt *Alcalies* (vulgarly reputed *ſolitary Salts*) being new textures of the *intrinſick principles*, do by that *neutrality* of *Eſſence* they are wrought into by the *Fire*, from new *complications*, I ſay, do make *different aſſaults* upon *Acids* then before.

Hence it is, that upon a double account, as I ſaid, that *Acids* mixed with theſe *Alcalies* may cauſe an *efferveſcence*, viz. either as meeting with the *Sulphur* cloſe bound up with the *Acid* and *urinous Spirit* or *Salt* in the compage of the *Alcali*, and ſo to cauſe an *Ebullition* and *Heat*, according to our foreſaid *principles*; or as meeting with the *volatile urinous Salt* cloſe rivetted with the *Sulphur* and *Acid*, may either way cauſe an *efferveſcence*.

Onely this difference (which is conſiderable) is to be noted betwixt theſe *Fermentations* made between *Acids* and *Sulphurs* as they happen in *petrifick concretions*, and *fixt lixivial Alcalies*; from thoſe which happen in the general courſe of *nature*, inaſmuch as *Fermentations* which are ſet awork amongſt *animals*, *vegetables*, yea, and many *minerals*, do produce a quite different effect from thoſe lately cited, as appears in *animal Fermentations*, their effects are the production of *animal Spirits*, &c. In vegetable *Fermentations* their effects are either ſuch which immediately reſult from the *ſlow pac'd motion* of the *principles*, viz. *Vegetation*, *Volatization* of their *Sulphurs*, *Odours*, &c. or are the effects of the more ſenſible *Fermentations* in all *vegetable juices*, in order to *potable Liquors*, which are *vinous Spirits*, or the effects of *mineral Fermentations*, which in done in the *bowels* of the *Earth*, where no current of *water* happens) are the productions of *mineral concretes*, &c. If where *waters* have their *Channels* (in their great *circulation*) their effects are *hot Baths*, &c. Or Laſtly, if the *Fermentation* be from *mineral bodies*, and *corroſive menſtrua*, the effects are *ſtifling fumes*, &c. All which in their different claſſes happen from the looſeneſs of the *compage* of their *Sulphurs*, and from their *facile inclination* to *volatization*. But in the late cited *efferveſcences* betwixt *Acids* and *Alcalies*, whether in *Petriſick* or *lixivial Salts*, their *Sulphurs* being naturally *fixed*, as in *Stony concretions*, and are made ſo in *lixivial alcalies*: So that although *Acids* may touch upon them and cauſe a little *fretting efferveſcence*, yet cannot *volatize* them; therefore upon their *colliſion* and *Ebullition*, we find no different *hogo* to ſmite our *Noſtrils*, the uſual *products* of other *Fermentations*.

And then as to *volatile Alcalies*, which put to *Acids*, cauſe a *fretting heat*, they do conſiſt of an *Acid* and an *urinous Spirit* (as in our *Halologia* we further demonſtrate) which being *complicated* together, retains ſo much of the *Acidum*, as is ſufficient to its *concretion* into a *ſaline form*, and yet is ſo much *ſubjugated* by the *Urinous Spirit*, as to be overpowered thereby; and from the neutrality of their *nature* to cauſe the foreſaid *efferveſcence*, being mixed with *Acids*.

In the next place, as to the reaſons of *Fermentation* contracted in *quick-lime*, from the *affuſion* of *water*; in ſhort thus, we ſuppoſe (and think to demonſtrate) that *heat* to proceed from a *Fermentation*, betwixt *Salts* of a different *nature*; which upon the *affuſion* of *water* are diſſolv'd, and thereby ſet into an *actual ſtrugling*. Theſe different *Salts* are an *Alcali* and an *Acidum*: Now that *fixt alcalizate Alcalies* (not *lixivial* of *Plants*) are diſſeminated in the *bowels* of the *Earth*, to which *petrifick concretions* chiefly *owe* their *original*, we at large ſhew in our *Lithologia Phyſica*; and that ſuch a ſort of *Alcali* is implanted in *calx vive* (which in the *calcination* required to the making thereof, becomes yet heightened) is evident, Firſt, by its *mortifying*

ing and *ſweetening Acids*, witneſs its being pu
to *water* acidulated with *Spirit* of *Salt*, *Nitre*
&c. the *acidity* will preſently be altered, an
mortified: next by its cloſing *Acids* wrapt u
in the texture of another *body*, as appears b
its mixture with *Sal armoniack*, where it
Alcali, (for it can be no other) catcheth hol
of the *Acidum* of *Sal marine*, and ſo break
the *compage* of the *Armoniack Salt*, ſetting th
volatile Urinous Spirit at liberty. Thirdl
by the *heat* it makes (after *extinction* by a
fuſion of *water*) with an *acid Spirit*, as whe
Spirit of *Vitriol* is poured upon *extinguiſh'*
Lime, a heat is thence cauſed. Laſtly, By th
obſerving that the *water* of its *extinction*, wi
ſerve to open the body of *mineral Sulphur*, b
boiling them together, which it will do almo
as well as if the *water* had been *acuated* wit
fixt lixivial Salts: both which work upo
mineral Sulphurs by their *Acids*, as we ſha
demonſtrate more clearly afterwards.

And as to the *Acidum* in *quick-lime*, we ſa
it owes its *original* to no other then to that
Fire, contracted in the *calcination* of the *Ston*
and that it was not *pre-exiſtent* before *calc*
nation. Now that *Fire* in the actual *flagratio*
of combuſtable *bodies*, doth (in that *violen*
Fermentation of its *principles*) fix its *acidu*
(while the *Sulphurous principle* wheels off int
the *Air*) upon ſome *bodies* it meets witha

ſuitab

ſuitable for the reception thereof; and how that from the difference of *Acids* in ſeveral *combuſtable concretes* by *flagration*, intangling themſelves with, and *fixing* upon other *bodies*, different effects are *produced* : I might *confirm* by many inſtances.

The former is evident (amongſt the reſt) in the *reverberatory calcination* of *Lead*, in its *preparation* into *minium*, where the *Acidum* in the *flame* of *Wood*, centers and fixeth it ſelf upon the *Lead*, and gives conſiderable increaſe of *weight* thereto : So in like manner (to come nearer to our purpoſe) the *Acidum* of *Cole* in the *calcination* of *Lime-Stone*, doth by a continued *reverberation*, fix it ſelf in the *cranies* and inward *receſſes* thereof: Thus in the *calcination* of *Vitriol* by the rayes of the *Sun*, in the preparation of the *Sympathetick powder*, the *pondus* thereby becomes increaſed.

And then as to the latter, *viz.* the different effect upon *bodies* from the variety of *Acids* in actual *ignition* or *flagration*, either *fixing* themſelves thereon, or at leaſt by ſome *ſleighter intruſions*, ſhewing a different *operation*, we could demonſtrate from our *obſervations* upon burning of *Bricks*, hardening of *Iron* or *Steel*, calcinations of *minerals* and *metals*, various *reverberations*, and many other *mechanical operations*, (ſolely owing their *original* to the difference of the foreſaid *Acid*;) nor to ſay here, how amongſt other *Phænomena*, the difference of *colours* amongſt *minerals* and *metals*, contracted by *calcinations* and *reverberations*, owe their *original* to this ſource of *varieties* of *Acids* in different ſorts of *Fires*, which for brevity ſake we now omit, referring to a further *diſcourſe thereof* in another place.

By the power of the foreſaid *Acidum* in *quick-lime*, communicated thereto by *Fire*, in the *calcination* thereof, it is, that the *water* of *Lime* will perform what other more uſual *Acids* cannot; for inſtance, That *Lime-water* mixed with any *volatile Urinous Salt*, and diſtilled therefrom, fixeth, yea, turns the *Salt* into an inſipid powder, or *indiſſolvable calx*: concerning which, the ingenuous *Zuelfer* well notes, *quin etiam* (ſaith he, ſpeaking of this very thing) *huic aquæ recenti ſalia volatilia jungerem, moxq; vidi effectum*, ſc. *ſalium dictorum totalem deſtructionem, & eorum in calcem vel pulverem inſipidum indiſſolubilem, omni odore, & ſapore, privatum, igniſq; violentiam in poſterum ſtrenue ſuſtinentem, converſionum.* The like probably would *minium* do to the ſame *volatile Salts*, if mixed therewith, and that from the ſame cauſe, *viz.* the *Acidum* contracted by the *Fire*, and from the ſame *Acidum* it is alſo, that *water* of *Lime* caſt plentifully upon *boiling Milk*, will *curdle* it. And from theſe two, *viz.* the *Alcali* and *Acidum* (which

wi

we have demonſtrated to be in *quick-Lime*) put into a *ſtrugling fretting motion*, by their *ſolution* in *water*, is (according to our *Hypotheſis*) the very cauſe of *heat*, obvious in *quick-Lime*: For unleſs theſe two be diſſolved, no *Fermentation* happens, and conſequently no *heat*. Hence it is, that although rectified *Spirit* of *Wine*, *Spirit* of *Turpentine*, or other ſuch like *Sulphurous Liquors* be added, yet cauſe no *heat*, becauſe they are not competent *menſtrua*, nor ſuitable *Liquors* for the diſſolving the foreſaid *Alcali* and *Acidum*, from whoſe *ſolution* and *combating motion*, proceeds the *heat*: But we have at large *diſcourſt* upon that ſubject in our *Lithologia Phyſica*, to which I refer the Reader therefore ſhall now forbear further to inſiſt thereon.

CHAP. X.

LAſtly, as to *heat*, and ſometimes *ignition*, which is cauſed from the *colliſions* and *attritions* of hard ſolid bodies, we may without any difficulty *ſolve* from our formerly depoſited *principles*: As (for inſtance) that *heat* and *ignition* which proceed from the *attritions* and *percuſſions* of *Flint* and *Steel*, the *attritions* of *Steele* and *Wood*, of *Steel* and *Pyrites*, or any other *Gritt* or *Free-ſtone*: The *at-*

tritions of either ſappy or dry *wood*, as happens in the *violent motion* of the Axis, or *Wheels* of *Coaches*, *Chariots*, *Wagons* or *Mills* : all which *Phœnomena* we can well (and we think rationally) charge to the account of our former *Hypotheſis*, viz. That they are performed no other way, then by a quick and ſudden *excitation* of the *implanted principles* of *Acid* and *Sulphur*, being by percuſſion, alliſion or attrition put into a ſpeedy *Fermentation*.

For the better underſtanding whereof, we are to conſider both the *nature* and *temperament* of thoſe *bodies*, as alſo the manner of the production of *Heat* or *Fire* therefrom, as to the firſt, they are all of them ſuch, in whoſe texture our *principles* of *Fermentation*, viz. *Acid* and *Sulphur*, lye ſcattered and interſpers'd; what are *Flints* and other *Pyrites*, but *ſtony concretions*, who have a *Sulphurous principle* for their *cement*, which lyeth cloſe ſhut up in their bodies, eſpecially in ſome of them, the *flagrable Sulphur* is ſo faſt *locked up*, as that it appears not by any uſual manner of way : unleſs either by *attrition* of other *bodies* (wherein an *Acid* and *Sulphur* hang more looſely, *viz.* *Iron* or *Steel*) or by the *ſolution* of ſome powerful *menſtruum*, ſuch as the *grand ſolvent* the *Alchaheſt* : whilſt others of them have their *Sulphur* more eaſily *extricated* : of which laſt ſort it is *G. Fabricius* ſpeaks when he ſaith that out of any the *Pyrites*; *equo excutitur ignis, excoquitur etiam Sulphur.*

What is *Iron* or *Steel* (the latter being but the former hardened) but a *metal* wherein eminently (above the reſt of *metals*) doth appear an *Acidum*? witneſs its eaſie *mouldering* into *Ruſt*, being a natural *calcination* thereof by the bare *acid moiſture* of the *Air*: For what *Fire* by its *Acidum*, doth to *Iron*, looſening the *innate acidum* thereof by actual *calcination*, the ſame in a longer tract of time doth the *connate acidum* of the *Air* to the *inbred acid* of *Iron*, which then working upon the *native Sulphur* doth unhinge it, and ſo together taketh in pieces the whole *body* into a *crocus*; And although *Copper* hath alſo an implanted *acidum* (the chief cauſe of its contracting an *erugo* in the *Air*) yet it is not ſo eaſily *extravertable* by the *acidum* in the *Air*, and therefore *defends* it ſelf the better from the *injuries* thereof.

Laſtly, (not now to name any more) what is *Wood*, whether in a *ſappy Branch* or *dry* (but firm) ſtick, but the more ſtrong *concretions* of *vegetable juices*, wherein the foreſaid *principles* of *Acid* and *Sulphur* are, in the one *freſhly acting* in the work of *vegetation*, and in the other *lye dormant* under the bonds of *coagulation*: So that if the ſame *principles* be actuated and accelerated in their *motions*, as they are by ſudden *colliſions* and *attriſions*, they may thereby be put into ſtronger *Fermentations*; and at length be *invigorated* to that height, as actually to take *Fire*: which (according to our *Hypotheſis*) is the very reaſon why a *Green Branch* or Stick, by ſtrong and frequent *attritions* (one part upon another) will *Fire*; alſo why the *Axis*, *Staves*, or *Wheels* of *Coaches*, *Wagons*, and *Mills*, will from ſtrong and violent *motions* and *attritions*, take Fire and burn. The like may be ſaid concerning all the other foregoing Subjects, as to the cauſes, or manner of their *ſtriking Fire*; which now we ſhall inſiſt no longer upon: only this (by the by) I would take notice of (before I have done with this matter) that *frications* (which are ſleight attritions) of the parts of the body, which by the *Ancients* were much in uſe, towards the aſſiſting the cure of many Diſeaſes, whoſe peccant matter lay much in the habit of the body, were grounded upon this very reaſon, *viz.* that they thereby help'd the *Fermentation* of the *blood*, and other *dormant juices* which lay *coagulated* in the outward parts of the *body*, benumbing the *Nerves*, *Muſcles*, and other outward *parts*; and that if *Phyſicians* would now more *frequent* the uſe thereof, might probably find an advantage thereby in order to the *Cure* of *Diſeaſes* by invigorating thoſe dorming *Ferments*, putting them into *action*, whereby the *offending matter* might the better be *diſcuſs'd* and *evaporated*.

CHAP. XI.

THus having (as compendiouſly as we could) run through the cauſes of *Heat* and *Fire*, as the reſult from all ſorts of *Fermentations*, in the *triplicity* of *natures Empire*: and ſhewed *Heat* to be *Fire* in a *remiſs*, and *Fire Heat* in an *intenc'd degree*, or if you will a ſlow or more quick *motion* of the *principles* (I mean *Fermentations*) ſolves both; and ſhewed alſo theſe *Fermentations* to proceed from a wreſtling of *Acidum* and *Sulphur*, excepting thoſe made from an inteſtine ſtrugling of *Acidum*, and a fixt *Alcali*, or *Acidum* and *Urinous Spirits*: Now come we to the laſt thing we propounded, and that is, how from our depoſited *Doctrine* of *Fermentation*, to ſolve that other grand *Phænomena*, viz. *Light*.

Not now to treat of Light as it is *communicable* to us from the great *Fountain* thereof, the *Sun*, which, as we ſuppoſe, conſiſts in an *illumination* of *Air* by a perpetual emanation or eradiation of *ſolar beams*, ſpringing from an inceſſant, but peculiar *Fermentation* in the body of the *Sun*, and foſtered by an unwearied *circulation* of Æthereal matter, *Light* and *Heat*, as proceeding from the *great ſource* thereof, we conceive to differ only in this, *viz.* That *Light* is the bare *illumination* of the medium the *Air*, by a direct *progreſſive motion* of Æthereal matter, from the foreſaid *Fermentation*, as the proper *object* of the *Eye*, and by which all other things are ſeen, while *heat* is the *reflection* or *reverberatory motion* of the ſame *luminous beams* (proceeding from the ſaid *Fermentation*) from the *Earth* or other ſolid *bodies*, affecting (by that *Fermentative motion*) our Organs of *feeling*, concerning which, we may elſewhere modeſtly propoſe our opinion.

Our deſign at preſent is, onely to diſcourſe of the *nature* and *manner* of ſuch ſort of Lights, which we find amongſt *bodies* we uſually converſe with upon the *Earth*, and within the verge of our *Atmoſphere*: which are as followeth, *viz.* the Light of culinary *Fire*; I mean, of moſt uſual *combuſtable concretes*, the Light of all *Sulphurous matters*, whether in the form of *mineral Sulphurs*, *Gumms*, *Roſins*, *Turpentine*, *Axungia's*, &c. or in liquids of *Bitumen*, *Oyles*, *vinous Spirits*, &c. The Light of rotten *Wood*, long dry'd *Fiſh*, as *Codds*, &c. who have an *incipient putrefaction*; The Light of *Glow-worms*, *Cats-Eyes*, Light from attrition of *Wood* green or dry, which have thereby taken *Fire*, from the attrition or percuſſion of *Steel* and *Flint*, or any *Pyrites*, from the frication or pectation of *animals:* ſuch as are Light from the Combing a *Womans* head (as ſometimes hath been known) Light ſtruck in the *currying* of a *Horſe*; and that Light I have ſeen from a ſudden *frication* upon a *Catts-Back*; of ſome *Liquors* the Light of *ſubterraneal Lamps*; the perpetual Light preparable by the *exuberate Mercury* of the *Philoſophers*, graduated by *circulation* and *cohobation*, according to our Engliſh *Anonymus*, who had ſeen it done.

The Light of ſome *precious Stones*, as *Carbuncles*; ſome ſort of *Diamonds*, magnetical of Light, as the *Bononian-ſtone*, prepared by an artificial *calcination*. Laſtly, The Light of *meteors*, amongſt which may be reckoned Lightening, *flaſhes* of *Fire*, or Light ſeen in Storms upon the Sea, alſo thoſe *luminous meteors* which in great Storms at Sea are ſeen to *cleave* to the *tops* of *Maine Maſts*, and at the *Sterns* of *Ships*, by the Ancients call'd *Caſtor* and *Pollux*, by our Engliſh-men *corpus-Ants*, and very probably is the ſame with that *meteor* we call *ignis fatuus*, of which, as alſo concerning the Light ſeen upon the impreſſions of footings in the *Sand* upon Sea-ſhores: we ſhall ſhortly ſpeak more.

All which give Light in the Dark, *viz.* in the *Air* not *illuminated* by any Light from the *Sun*; ſo that we may ſay of things that occur to our ſight, that they carry Fire and Light in their Bellies, and that by an *excitation* of their intrinſick *Ferments*, their *inſide tapores* are ſet above board : It remains therefore that we try theſe Lights,and examine whether all or moſt of them, may not (according to our *Hypotheſis*) be *ſolv'd* from various degrees of *Fermentation*, grounded upon our *principles* of *Acidum* and *Sulphur*, from various cauſes differently *excited*.

We ſhall begin with that which is moſt *obvious*, viz. *culinary Fire*, and examine how Light is produced therefrom : no ſooner are the inbred *Acidum* and *Sulphur* of any *combuſtable concrete*, ſet into a violent *Fermentation*, kindled by the *Fire* or *ſymbolical Fermentation* (already in actual motion) put to it, but forthwith by the help of the *Air*, the *principles* are ſet into a *rapid inteſtine motion* : which yet more and more being ſharpened by the *Air*, ariſeth by *degrees* to that pitch, as to fall into an *actual ignition* ; and from thence being yet more *thin'd* by the *interweavings* of the *Air*, breaks forth into *flagration*, or *ignition* with *Flame* ; *Fire* and *Flame* ſeem to differ only in this, that in the *ſtruglings* of the *principles*, and thereby in the rejecting the *heterogenites*, the *Air* is more *complicated* in making *Flame*, then in bare *ignition*, Flame being but Fire, *rarified* by the *intertexture* of *Air*,which by ſuch *rarifaction* of a dark cloudy ſmoke or fume, makes a *diaphanous Flame.*

Air is neceſſary for *ignition* and *flagration* upon a double account: Firſt, from its *moiſture* (brought into it from the grand *Fermentation* and *Circulation* of other *Bodies*) whereby the *principles* of Firing become more *liquid*, and thence fall into a more intenſly furious and colliquating *Fermentation*, according to that of *Silenus* the *Epicurean*, brought in by *Virgil*, *ſemina terrarum*, &c. ---*Et liquidi ſimul ignis*; next by its own peculiarly, plyable, penetrative, and circulating *nature*, whereby it inſinuates into every of the *principles actings*, keeping them in a conſtant agitation, thereby maintaining their *wheel* of *motion*, as long as any *combuſtable matter* remains, and is well put together.

So that by the firſt qualification, *Air* by its ſpongy nature, imbibes *moiſture*, wheeling off from other *bodies* in their inceſſant *Fermentation*, and thereby becomes qualified for keeping other *Fermentations* afoot, and then by its other *qualification* of penetration, and being as a *Fan* to *blow* off the *looſe Corns*, (as I may ſay) or *heterogenious matter*, ingendred by the foreſaid *rapid Fermentation*: And by both it becomes truly capable of aſſiſting the *principles* of *Acidum* and *Sulphur* in their furious *combating*, as thereby to turn vaſt *bulkie bodies* of combuſtable matter, firſt into *Fire* and *Flame*, and at laſt (by winding off) into *water*, leaving ſome few *Aſhes*, wherein remain ſome *Salt*, and in ſome *vegetable concretes*, the *ſeedling* of the former body: For all combuſtable bodies, are by this agitation of the *innate Acidum* and *Sulphur*, with the co-operation of the *Air* (in that double foreſaid reſpect) reduced after a little rotation into the Air, to *water* again; And although *Fire* moiſtens no bodies put thereto, yet doth it really go off, not onely in a *liquid*, but *humid form*, witneſs the condenc'd *ſteams* of *mineral Sulphur*, or Brimſtone, burning under a Glaſs *campane*, is ſav'd in an *acid Liquor*, alſo Spirit of Wine, fired and condenſed by ſuch an *artifice*, appears in an *inſipid water*: yea, for ought I know, the like might happen (with ſome ſmall variation) to moſt combuſtable bodies, if their *fumes* were *condenced* by ſuch a contrivance: however the Air at the long run *condenceth* all thoſe ſteams (*Fire* wheeleth off in) into *water*.

This being premis'd, we ſay that the higheſt degree of *Fermentation*, whereby the *principles* are put into a *rapid motion*, maketh *Fire*, and that is done by the help of *Air* as aforeſaid, which *Fire* of *ignition* gives Light by a continual winding off in *luminous rayes*, ſpringing from the foreſaid *Fermentation*, and that by the further *complications* of Air, interwoven in the texture of *Fire*, whereby the otherwiſe *groſs fumes* gains a more Æthereal *liquidity*, is that we call *Flame*, which is yet more *luminous* then bare *ignition*.

Not here to inſiſt, whether Light, either of the *Sun*, or other *luminous bodies*, be made any other way then by *refraction*; for although the rayes of the *Sun* make their *exit* in *right lines* from the ſource of their *Fermentative motion*: yet being to wade through a *fluid medium*, I mean our *Atmoſphere*, where, ever and anon hitting upon *liquid particles* of rarified *water*, born up by a Columne of the ſame, extended perhaps as far as the *ſurface* of the *Earth*, (and may be further) muſt needs have their *Lines* broke, their *Files* diſordered, and their *Rayes* much altered, being put into *oblique motions*, amongſt ſuch a Sea of *watery atoms*: Notwithſtanding which *refraction*, a luminous body may not undergo any ſenſible variation as to *locality*, and that becauſe our *Eye* is plac'd in the ſame *medium* with the *luminous body*, (if ſuch as repreſented to us here below) And as to the *Sun*, perhaps that may be the very reaſon of the difference betwixt the apparent and real place thereof: whereas, an object ſo *ſcituate*, as to have the reflecting *luminous rayes* to paſs through two *mediums* of different textures, muſt need ſuſtain a greater difference, as to the *locality* thereof, witneſs an *oar* part immerſt in *water*, part out, or a piece of *Silver* in a *Baſon* of *water*. But a *luminous body*, becoming ſuch by having its *principles* of *Acid* and *Sulphur*, heightened by a furious *Fermentation*, and being plac'd in the ſame *medium* with our Eye, the *luminous rayes* continually winding off in that *rapid motion* of the combating *principles*, although (I ſay) they make their *Exit* in *right Lines* from the *Source* of their *motion*, (viz. the body they iſſue from) yet muſt they be continually *hitting* upon *watery Atoms* they meet with in the Air, which are many times back'd with ſtrong *Cylinders* of the ſame, whence they are *diſtorted* from their *right Lines*, and become *refracted* from each of the adjacent *watery bulla's*, whereby, for ought we know, the *rayes* of ſuch *bodies* in their *illuminating motion*, may become the more *intended*, then if they ſhould have reach'd the *Eye* in *right Lines*, directly from the *object*.

For hereby thoſe *watery particles* may become as ſo many *minute apake Specula's*, by which, each of theſe *luminous rayes*, being once broke from its *direct line*, becomes by various *reflections* and *refractions* multiplyed, firſt hitting upon one, then ſlanting off another, and ſo *ad infinitum*, yet retaining their firſt *impulſe* from the *Fermentation* or *tranſmiſſi-*

on from the *luminous bodies*, whereby thoſe rayes of *Light* are infinitely increaſed in their *illuminating property*, eaſily communicating a *diaphaneity* to the adjacent and *ambient Air*, to confirm which, we may obſerve how notably a *ſtream* of *watery particles* caſt from a *Spring*, through a *Cylinder* of *Sun-beams* (the eye being placed in the ſhade) cutting it at Angles, intends the Light thereof, make by *reflections* and *refractions* new appearances of Light.

CHAP. XII.

THus much concerning *Light*, as proceeding from *culinary Fire*, or from ordinary *combuſtable concretes*, put into that rapid furious *Fermentation* we call *Fire*: The ſame we may ſay of the cauſes of Light in all *Sulphurous matters*, whether in the dry form of *mineral Sulphurs*, *reſinous Gumms*, *Turpentine*, &c. or in Liquids, as *Bitumen*, *Oyles*, *Vinous Spirits*, &c. All of them in their *flagration* or *flammability* requiring Air, and that in the double acceptation thereof, as aforeſaid. We ſhall therefore in ſhort take leave to ſay, that theſe have their intrinſick *principles* of *Acid* and *Sulphur*, ſet awork into an *actual flagra-*

tion, by being kindled by ſome *congenial* fier *Fermentation*, and that by the aſſiſtance of th Air both as a Sponge and as a Fan, eſpeciall the laſt, which thereby not onely promotes th *incipient Fermentation*, but alſo is neceſſaril required for the *perpetuation* thereof, as lon as any of the *principles* remain yet unwoun off by *flagration*.

That there is an *acid principle* in all theſe we may elſewhere prove by demonſtrable an undenyable arguments, &c. That there is alſ a *Sulphurous principle*, no eye will doubt i upon beholding their *flagration*, inaſmuch, a according to the vulgar acceptation, *Sulphu* muſt be in all *combuſtable matters*, onely w may obſerve, this difference there is betwix common *culinary* combuſtable *matters*, an thoſe laſt named, *viz*. That the firſt are complicated with more *heterogenious matter*, wrap up in the texture of thoſe *concretes*; the latte are more *ſimple*, come nearer to the *nature* o the *principles* themſelves, and therefore ar the more readily and eaſily *flagrable*, and conſequently ſooner give their *exuberant Light* to which the Air hath more eaſie admiſſion towards the keeping the *principles* at work and to the facile boying them up in a conſtan *luminous* aereal *flame*, burning without glowing, or any conſiderable reſidence of a *Capu* *mort*, eſpecially in ſome *Oyles*, and in all rectified *vinous Spirits*.

Th

The ſame may be ſaid of *Light*, ariſing from attrition of Wood green or dry, which having its *inward principles* of *Acid* and *Sulphur* rouz'd up by so *quick* a *motion* as attrition produceth, gives the ſame appearances of Fire and Light, and that from the ſame cauſes, as that which is done by *actual flagration* from other external *Fire* added thereto.

So likewiſe the ſame may be urg'd in the ſolving the *Phœnomenon* of *Light*, ariſing from *attrition* or *percuſſion* of *Steel* and *Flints*, or any *Grit-ſtone* or *Pyrites*; for as by that ſudden motion of attrition or percuſſion, the *acidum* of the *Steel* and the *Sulphur* in the *Flints* or *Pyrites*, are ſet into a *rapid Fermentation*, whence (as we have ſhewed before) ariſeth *Fire*: So Light being the immediate product and reſult of *Fire*, muſt needs appear. Wherefore the cauſes of *Fire* and *Light* ariſing hence, are the ſame with thoſe produc'd from others more obvious, onely are differently put into *action*, yea the Air is as much intereſted in the *excitation* of the one, as the other: And that according to the qualifications and manner aforeſaid.

Nor need we go much further for ſolving the reaſons of *Light*, which appeareth from *frication* or *pectation* of ſome *animals*; ſuch as are Light from the *Combing* of a *Womans head*, (as hath been known) that *ſtruck* in the *curry-*

ing ſome *Horſes*, and that from a ſudden *frication* of a *Cats back*, if we conſider the two firſt, as depending upon the *peculiar texture* and ſingular *diſpoſition* of the *Fermentative juices*; For it is not all individuals of either of the *ſpecies*, from which that appearance of Light is *obvious*; but onely thoſe in whoſe *conſtitution* the *principles* ariſe, or are graduated to a peculiar *efflore ſcence*, in the very *formation* or genuine *production* of *animal Spirits*, carryed by the *nervous juices*, as their proper *vehicle*, into the habit of the *body*, which being *excited* by that ſudden *motion* of *pectation*, &c. readily by the help of the Air, give thoſe quick *flaſhes* of Light. And as to the laſt, *viz.* the ſtriking Flame or Light from a *Cats back* by *frication* in the *dark* (as I have ſometimes taken pleaſure to ſee done) that I cannot otherwiſe impute, then alſo to proceed from the peculiar *graduation* of the *principles Acid* and *Sulphur*, in the texture of that *animal*, and what is done by that ſleight artifice in exciting the *efflore ſcence* of the *principles* in a luminous *flame*, may (for ought we know) be done naturally by a briſk, but ſlender woven *Fermentation*, perform'd either in the texture of their *eyes*, or rather in the very *fabrick* of their *animal Spirits*, being a briſk *floridues* of thoſe *juices*, proceeding from a moſt depurate and heightly *volatiz'd Sulphur*, carryed away to the *Eyes* by the *optick Nerves*, from whence we ſuppoſe it is that their *Eyes ſhine* and give Light in the dark.

Which laſt I am induc'd to believe, *viz.* That this *luminous efflore ſcence*, peculiarly reſides in the *animal Spirits*, even in all the foreſaid inſtances, carryed by the *nervous juices* into the habit of the body, becauſe (in the laſt inſtance) the *frication* being made along the *Spina*, running down the *vertebre* of the back, *excites* that *volatile* and highly depurated *Sulphur*, into a *luminous flame:* whence its very probable, that many other *animals*, eſpecially thoſe which are highly fed, and whoſe *animal Spirits* are of a *fine ſpun texture*, having their *Sulphur* highly *volatiz'd*, would I ſay upon trial be found, (from the foreſaid cauſes excited by *attrition*, *pectation*, or the like) to give the ſame *luminous flame*.

In the next place, we come to give the reaſons of Light in *rotten Wood*, and *dry'd Fiſh*, &c. where we are to obſerve, that as in the cauſes of Light aforeſaid, from the *principles* of *Acid* and *Sulphur*, variouſly put into *motion*, being excited into a *Fermentation* divers ways: So amongſt the reſt, this by *putrefaction* is not the leaſt; for Wood ſhines not till its *principles* of *Acid* and *Sulphur*, by a retrograde motion, fall into a *new ſort* of *Fermentation*, whereby it winds off what the *principles* in their *generative Fermentation* wound on, *viz.* unravels its own *Clew*, taking in pieces what the other built up, in which *putrifick analyſis* the foreſaid *principles* make different aſſaults upon each other, by the *intermiſſion* of *moiſture* in the Air, fortified perhaps with an *acidity*, repugnant to that of the concrete: And as *moiſture* in the Air, is neceſſary towards the promoting *Fermentation* in a generative way; ſo likewiſe as neceſſary to the helping forward the deſtructive or retrogreſſive *Fermentation* in taking bodies in pieces.

For *putrefaction* always begins where the *principles* terminate their actions in *generative motions*, *viz.* upon the *external ſuperficies*, or *outward rims* of all Bodies, where the ambient Air touch them, and thence begin their *retrograde motion* in the natural *analyſis* of Bodies; which is evident from this obſervation, *viz.* That I know by an *artificial excluſion* of Air, how to preſerve moſt (perhaps all) ſorts of *Fruits*, newly taken off the *Trees*, as ſuppoſe *Gooſeberries*, *Apricots*, *Damſens*, *Cherries*, &c. ſo that in *January* I have had *Tarts* made of them to entertain Strangers with, as we elſewhere in our *Lithologia Phyſica* further ſhew.

So that it is from a peculiar ſort of *Fermentation* betwixt the *Acidum* and *Sulphur* in the unhingeing the compage of the concrete;

whence proceeds the flaming brightneſs of *rotten Wood*; For the *principles* are not all wound off, but onely are a going off in a *luminous brightneſs*, whence alſo proceeds its facile *ſuſception* of *Fire* from any Spark thereof: inſomuch, as the laſt Threds of *natures unraveling* in the reduction of bodies by *putrefaction*, (eſpecially in ſome) is of the fineſt ſort, the *volatile Sulphur* winding it ſelf off (by ſlender *vibrations* from the *connate acid*) in a ſubtile but *luminous rotation.*

The like account may be given of Light, from ſome ſorts of *Fiſh*, hung up till they undergo an *incipient putrefaction:* For while their *principles* of *Acid* and *Sulphur*, do by the *moiſture* in the Air, undergo a *putefactive Fermentation*, the *Sulphur* by thoſe retrograde motions, becomes more *volatiz'd*, and by gentle touches from its *inbred Acid*, winds off in a *luminous flame :* In which ſuppoſition we are the more confirm'd, inaſmuch, as they *ſhine* not till a ſleight *putrefaction* of their *juices* be already begun: To which may be added, that in their *putrefactive reductions*, a *mucilage* is made to appear, which is the *receptacle*, and as it were *ſperme*, wherein the two *principles* do the better ſhew themſelves in their *vibrations* and *luminous productions :* which *mucilage* the Fiſh imbib'd and incorporated into its ſelf, (according to all probability) from the *eſtuations* of the Sea, upon *Storms* and *Tempeſts*, of which we ſhall ſpeak further below.

As to the Light from *Glo-worms*, its probable that ſort of inſect takes its *original* from the *putrid juice* or excrements of ſome *animal* or other inſect, wherein the *principles* are *winding off* in a ſlender texture of an *eradiating brightneſs*, which juice that inſect yet *retains* : For I look upon the ſlender woven *flame* inherent in *Glo-worms*, and other foreſaid *putrid juices* to proceed from a mutual, but gentle *vibration* of the *principles* in their *retrograde motion*; which although without any *ſenſible heat* (that it has none, we dare not ſay) yet *ceteris paribus*, to be in ſome meaſure anſwerable (as to the *ground* of the *cauſes*) to that *flame*, made from the *principles* in their *generative motion*, heightened by *frication*, *attrition*, or the like, into a burning *luminous flame*.

CHAP. XIII.

NOw come we to treat of the production of *luminous Meteors*, and to enquire into the cauſes of their Light; ſuch I mean, as happen within the compaſs of the *Atmoſphere* : For the better underſtanding whereof, we are firſt to conceive of the *Earth*, as a body, in whoſe *intrails* various *Fermentations* (eſpecially ſuch as relate to *minerals*) are continually at *work* to the compleating the *generation* of *Minerals* and *Metals* to the making *Hot-Baths*, the producing the *fontes acidi*; and to the perpetuating other grand *Phænomena* of *Nature*: Next, that theſe *Fermentations* of *ſubterraneal juices* (I mean as to the effects thereof) terminate not always upon the external *cortex* of the *Earth*; but are continually breath forth: whoſe *ſubtiliz'd* and *volatiz'd particles*, (eſpecially the *Sulphureous*) are inceſſantly paſſing off in the ſlendereſt of *textures*, *viz.* in a ſubtile *apporrhea*, or inviſible *ſteame* into the *Atmoſphere*, filling it with plenty of *agil* nimble *parts*, floating in the Air, as in their proper *Sea*, and diſſolv'd therein, as in their peculiar *fluid menſtruum.*

Alſo we are to conceive, that the *Atmoſphere* doth not onely *lodge* plenty of the foreſaid *effluvia*, ariſing from *mineral*, but likewiſe from *animal* and *vegetable Fermentations*, wheeling off in *tenuious combinations*, and ſlender woven nexures, (undiſcernable to our Eyes, although fortified by the beſt *microſcopes*) whereby the Air becomes the common receptacle of *innumerous multitudes* and *ſwarms* (as I may ſay) of *volatiz'd Acid* and *Sulphurous particles*, not onely iſſuing through the pores of the *Earth*, but alſo from other bodies upon the ſurface thereof, continually ſpending themſelves in inſenſible *effluvia*, kept a foot by their *unwearyed Fermentations.*

In which conſideration we are to apprehend of the *Earth*, not onely as the common *matrix*, impregnated with thoſe inteſtine *Fermentations* from *mineral juices*; but alſo as from whoſe *exuberant lap*, plenty of other more ſimple, and ſometimes ſenſible (I mean *watery*) *ſteams*, are, eſpecially from *ſpringie places*, continually iſſuing forth: inſomuch, as thoſe laſt are diſcernable to a curious eye, intently looking upon the ſurface of the *Earth*, a little after *Sun-riſe*, the eye being ſomewhat elevated above the *Level* of the *ground*, and directed towards the *Sun*, by which *curious obſervation*, Springs themſelves are ſometimes found out.

And as the *Earth* in the conſideration aforeſaid, ſo alſo every particular *concrete* has its *Atmoſphere*, more or leſs extending its *orb* of *activity*, according to the quick or ſlow pac'd *inward Fermentations*, I mean, according to the more brisk or flat *onſets* and *encounters* of their principles *Acid* and *Su phur*: And further, that many of thoſe ſlender woven *combinations*, are by reaſon of their tenuity, ſo indiſſipable, as to retain the *ſpecimen* of their *firſt original*, even after long, at leaſt ſuccedanedaneous rotations in the *Atmoſphere*, whereby they become capable of performing other *effects*, to which they are naturally propence, from the *occurrance* of other *co-working* cauſes, as is evident in many *unuſual effects* in or from the Air, whoſe cauſes, lying ſo remote from our ſences, we do not eaſily apprehend, concerning which, we have not time now to reckon.

Theſe *conſiderations* being premis'd, it will not be difficult hence to ſolve the *Phænomena* of thoſe ſhort liv'd *luminous* textures, *Meteors*: where we ſhall not need to our help, to call in, either the *exhalations* of the *Peripateticks*, becauſe grounded upon improbable cauſes, amongſt which that of the ſuppoſition of *extrinſical heat*, as the efficient, is not the leaſt: Or the *Carteſian Globuly*: Or *Gaſſendus*, his *Glomeres*, being ſuppoſed complications of *Nitro-vitriolick-Sulphurous-ſteams*: Or *Nitro-aereal particles*, common to the Air and Nitre, according to the *Hypotheſis* of a late Author. Nor laſtly ſhall we call in any other *Hypotheſis* to contribute to our aſſiſtance: But ſhall ſtudy to trace the *footings* of our own *principles*, although making their way through (as yet) hidden and unknown paths; making our *free inqueſt*, whether *Meteors*, may not from our foreſaid *principle*, be genuinely and ſatisfactorily ſolv'd.

We ſay therefore, that amongſt the *Mineral* and other *Apporrhea*, the *Sulphurous*, eſpecially the *Acido-Nitro-Sulphurous* are not the leaſt; which muſtering in *long-droughts*, when the Clouds *ride high*, being born up at thoſe *ſeaſons* by a ſtronger *elaſticity* of the Air, upheld by ſtrong and long *Colums* thereof, and one Cloud being higher then another, by its own weight (and wanting ſtreſs of Air to bear it up) falls upon the *ſubſiding*; which by the ſudden *percuſſion* of the Air, makes that *exploſive motion* or *crack* we call *Thunder*, together with a *ruſhing wind*, which uſually attends thoſe *Thunder-claps*, which is nothing elſe but a preſſure of Air, circulating from the *coincidence* of the two *Clouds*: Now by the ſudden *alliſion* of the foreſaid *Clouds* upon the *Acido-Nitro-Sulphurous-complications*, floating in the *Atmoſphere* (as aforeſaid) heightens them into a *quick vibration*, and *momentary flagration*, we call *Lightening*; which although it be done in the very ſame *moment* with the *crack*, as proceeding both from the ſame cauſes with different reſpects; yet becauſe *luminous percuſſions* do more *quickly* make their *tranſits* through the *medium*, therefore it is ſooner *ſeen*, then the other *heard*, (as might further be illuſtrated, if I would now inſiſt upon it.)

So that *Lightening* owes its cauſes to the ſudden *percuſſions*, or *attritions* of the *Acido-Nitro-Sulphurous apporrhea* in the Air, made by the ſudden falling of one *Cloud* upon another: which we cannot better repreſent by *ſimilitude* to our *underſtanding*, then by the obſervation of a *ſudden flaſh* of *Fire* or *Light*, ſtruck from the alliſion of a *Flint* and *Steel*: For the thin *Acido-Nitro-Sulphurous textures*, are in that part (as well as in others) of the *Atmoſphere*, which is comprehended betwixt two *Clouds*, and the *percuſſion* of the Air, as alſo of thoſe foreſaid *minute effluvia*, wheeling in the Air, make them to appear in a *ſudden flaſh*, as happens from the foreſaid *alliſion* of *Flints* and *Steel*.

Not here to inſiſt upon the reaſons, why (according to our *Hypotheſis*) Lightening is ſometimes ſo *penetratively powerful*, as to kill *men*, or other *animals*, without the leaſt appearance of any *bones* broke, or breach of *skin*; How ſo piercing and liquifactive a *cauſtick*, as to melt a *Sword* in the *Scabbath* (which ſometimes has been known) while the *Scabbath* it ſelf has remain'd ſafe? Why it comes with ſuch *force* and *fury*, as ſometimes to tear up by the *Roots* the ſtrongeſt *Oaks*, and other *Trees* of *mighty bulk*; and other-while breaks and ſplits the bodies of huge *Trees*; throws down *Houſes*, overturns *Wind-Mills*, and cauſeth other the like *Cataſtraphies*, diſmal and frightful to behold: witneſs amongſt the reſt, the late ſad and dreadful calamity, which happened from *Lightening* and *Thunder* the laſt year, in ſeveral Citties in *Holland*, but chiefly in *Vtrecht*; which although that, and the like, be Judgements from GOD, yet are not without their natural cauſes.

And from the foreſaid *Acido-Sulphurous effluvia*, paſſing through the Sea, and ſometimes gliding upon the ſurface thereof, happens thoſe *ſudden flaſhes* of *Fire* or *Light*, taken notice of by ſome *Sea-men*, by them ſeen in *Storms* upon the Sea, *ſhining* in the Night like *Fire*, being ſtruck up by ſudden percuſſions betwixt *Air* and *Water* from the furiouſneſs of Storms; whoſe *corruſcation* is obſerv'd in more plenty, during the *colliſions* of *Clouds*, *Winds* and *Seas*, whence Storms and Tempeſts then at any other ſeaſon.

The like may be ſaid as to the cauſes of thoſe *luminous*, but narrow-ſiz'd *Meteors*; which in great *Storms* at *Sea*, are ſeen by *Mariners* to cleave to the Maſts and Sterns of Ships, anciently called *Caſtor* and *Pollux*, by our Sea-Men *Corpus-ants*; in both which, the foreſaid *apporrhea*, whether floating in the Sea, or Air, *conterminous* to the Sea, being agitated, the one into a *Fermentative flagration*, or thin-woven flame, the other into a *figur'd Meteor*;

in both, I ſay, the foreſaid *Acido-Sulphurous effluvium* is ſtruck up into a *luminous flame*, by the fore-nam'd *attritions* and *percuſſions*.

Which laſt, I mean the *Corpus-ants*, are very probably (as my ingenious Friend *J. R.* well obſerves) the very ſame *Meteor*, upon the Land, we call *ignis fatuus*, which ſeemeth to run before people, and is ſometimes in *Storms* ſeen to *cleave* to *Horſes Maines*; which I ſay is very likely to be carryed by *Storms aſhore* to inland places, and that too at remote diſtances from the Sea: which *ignis fatuus*, or *noctivagus*, is obſerv'd in greater plenty in or upon *Storms*, and more rare in a *clear* and *ſerene* Skie.

And laſtly, (to name no more) we may reckon that ſort of *Light*, to be from the ſame cauſes with that of *Meteors*, which my foreſaid ingenuous Friend (whoſe unſuſpected veracity in matter of fact, is ſufficiently obliging to me, to be credulous of his relation) has obſerv'd to appear in *dark Nights*, upon walking on the *Sea-ſhore*, in every impreſſion of his *Foot*, upon the lifting up his *Heel*, he eſpied a *Light*, or *ſparkling brightneſs*, with which being ſurpriz'd, and deſirous to know what, and whence it was, fetch'd a *Lanthorn* and *Candle*, took up in his hand ſome of that *matter* which gave the *Light*, which he found to be a *mucid* matter *fere inſtar pituitæ*, and that he had often ſeen this *matter*, which was a *pellucid recrement*, caſt off upon the Shore, from a boyling Sea *æſtuating* with *Storms*.

So that it ſhould ſeem, as if by the *percuſſions* and *attritions*, betwixt *Wind* and *Seas*, made by Storms, upon the *mutual colliſions* of the aforeſaid *principles*, or *effluvia*, whether in *Water* or *Atmoſphere*, or both, not onely the foreſaid ſudden *appearances* of *Meteors* happen, but alſo by the *eſtuating* of the Seas, a *mucilaginous matter* is ingendred, wherein as a *ſperme*, thoſe forenamed *luminous effluvia* (I mean ſuch as are ſtruck up by *percuſſion* and *attrition*) fix themſelves, which ſometimes is *hovering* in the Air, and cleaves to Maſts or other parts of *Ships*; other while is cariyed off by *Storms* upon the *Sea-Coaſts*, and thence further in *Land*, gives thoſe appearances of *ignis fatuus* and the like: and ſometimes, or in part is rejected upon the Shore, and gives cauſe for that foreſaid *Phænomenon* of *Light* in the *impreſſions* or *footings* upon the *Sands*, after Storms are over; and may contribute to the making ſome ſorts of *Fiſh*, upon their *putrefactive reſolutions*, give that uſual appearance of *Light*, according to the account we have given thereof above.

We might here take an occaſion of inſiſting upon other ſorts of *Meteors*, as *Mill-dews*, *Blaſtings*, &c. all which proceed from the ſame

Acido-ſulphurous effluvia, floating in the *Atmoſphere*, and ſtruck up, by the *mutual attritions* and *colliſions* of *winds*, *clouds*, and the like; being carryed in certain *Channels* or *Peroledi* of the *Air*, to the producing their *uſual effects*, but ſhall now wave any further diſcourſe thereof.

CHAP. XIV.

NExt to which, we come to enquire into the reaſons of *Light* from *precious Stones*; of which there are three ſorts, which will give *light*: firſt ſuch as ſhew their *native luſtre*, by ſhining in the *dark*, without any previous *excitation*; of which ſort are *native Carbuncles*. Secondly, Such as need a previous *frication* to the exciting their *Light* and *Luſtre*: of which are ſome peculiar ſorts of *Diamonds*; Or laſtly, Such as are *magnetical* by a preparatory *calcination*, of which ſort is the *Bononian ſtone*.

As to the firſt, *viz*. That of *Carbuncles*, the cauſe of whoſe *luminous rayes* we can no otherwiſe *attribute*, then to the *irradiation* of a glaurious incombuſtible *Sulphur*, diſſeminated through its whole body, *imbibed* in, and *fixed* to, a moſt *defecate* matter, (imbib'd, I ſay, whilſt that exquiſitely pure *petrifick matter*, was yet in its *priſtine juice*) through which that highly graduated *tincture*, or Philoſophick *Sulphur*, is inceſſantly *vibrated* ; concerning which we have diſcours'd more at large in our *Lithologia Phyſica.*

The ſame we may ſay of ſome ſorts of *Diamonds*, onely with this difference, that theſe to ſhew their *Luſtre*, require a gentle *excitation* by a *previous frication*, whereby the foreſaid *luminous* incombuſtible *Sulphur* gets more at liberty, and darts forth the better.

Now that ſome particular ſort of theſe do by a gentle *frication* ſhew their *luſtre* in the *dark*, I have from the *autopſie* of my worthy Friend Mr. *Shippen* : Yea that ſome ſorts of *Diamonds* are not onely *luminous*, but alſo *electrical* of a Needle after a previous *excitation* by *frication*, I am aſſur'd by the *honourable Boyle*, who acquainted me, he has had one of that ſort: As alſo, that the *King* (as he told me) has one that will do the ſame very remarkably.

As to the cauſe of Light in thoſe which by a foregoing *calcinatory* preparation, become *magnetical* of Light, of which ſort is the *Bonian ſtone*, (and perhaps others might be found out, that by the like artifice would perform the ſame.) It depends, I ſay, on, and proceeds chiefly from, the *peculiar texture* of ſuch ſort of *Stones*, ſo wrought upon and altered by the *Fire*, as not onely to *imbibe* as it were, the *rayes* of the *Sun*, but alſo for a time to *fix them*, ſuffering them leiſurely to go off again, and ſo become by *freſh impregnation*, capable of performing the like *emiſſions* of Light *ad Lubitum*: concerning which Light iſſuing from the three foreſaid noble *petrifick bodies*, we inſiſt more largely in our *Lithologia Phyſica*, to which (when extant) we refer the Reader.

And as to the Light of *ſubterraneal Lamps*, although thoſe be generally reputed (and that too by very learned and intelligent perſons) amongſt *Chymera's*, ſuppos'd to be merely *fictitious*, yet I am not altogether of their *opinion*; but do think, there is a poſſibility in *nature* for them to have been really performed. Now the reaſon why it is generally concluded in the negative, is taken from the defect of Air in thoſe cloſe *caverns*; inaſmuch as all ſorts of vulgarly known *Fire*, need the *acceſs* of *Air* to the keeping up that *rapid motion* in *combuſtable bodies*, which being ſecluded, thoſe *Fires* thence depending, of neceſſity muſt dye.

But we ſuppoſe, and in part know, that there is lodged in moſt, eſpecially in ſome particular bodies, an *incombuſtible Sulphur*, known chiefly to the *Adepti*, to whoſe invigorating *actions*, and enlivening *operations*, the outward *Air* of our *Atmoſphere* doth not at all *contribute*, yea during ſome particular *ſeaſons* of *working*, ought wholly to be *excluded*. To confirm the *poſſibility* in *nature* of ſuch kind of *Fire* that may be maintained and perpetuated without Air, I might add, that I have with my own Eyes ſeen a *Flame* or *Fire* in the *cavity* of a *Glaſs*, which as ſoon as the Stopple was taken forth, became (contrary to the *Genius* of all *vulgar Fires*) immediately *extinguiſhed*: So why might not thoſe ſorts of *Lamps* recorded in *Hiſtory*, to have been performed by the *Ancients*, (viz. amongſt the *Romans*, who might probably have the *Art* from the *Grecians*, and thoſe from the *Ægyptians*) have been *Fed* with ſuch kind of *Fire*, even in the greateſt *ſecluſions* of *Air*, and upon their being expos'd thereto, when found, might as eaſily and ſpeedily *extinguiſh*: concerning which, we may probably elſewhere further inlarge.

Laſtly, as to the *perpetual Light*, preparable by the *Philoſophers* exuberate *Mercury*, graduated by *circulation* and *cohobation*, as alſo a *luminous Liquor* demonſtrable by *Art*: upon which we ſhall not now inſiſt, both becauſe we do not pretend to be a Maſter of any ſuch thing; as alſo becauſe we have touched thereon in our *Lithologia Phyſica*.

CHAP.

CHAP. XV.

THus having compendiouſly run through the great *varieties* of *Fermentations* in the threefold *Kingdom* of *Nature*, and ſhewed the various *Phœnomena* of Light in different bodies, in that part of the *Scene* of *viſibles* we converſe with, ſolvable by our *principles* from different cauſes, put into various *motions*. Now it remains to conclude this Doctrine of *Fermentation*, firſt by elucidating our *principles* from *collateral authority* : Next, by ſhewing how from the great *variety* of *Acids* acting upon *Sulphurs*, may divers other *Phœnomena* be naturally ſolv'd.

As to the firſt, *viz.* to confirm and illuſtrate our *principles* to be in all *concretes* throughout the triplicity of *natures Empire*, beſides what we have in brief ſaid, and reſerve alſo for a *further diſcourſe*, we might here bring in the *Authority* of the great *Hypocrates*, and ſome others of the *Ancients*, to ſhew how this *concordia diſcors*, the *principles* I mean of *Acidum* and *Sulphur*, contracted into *Seedlings*, are interſpers'd in the *ſeminals* of all things ; whence by ſuch kind of *Fermentation* (as aforeſaid) all things *vegetate*, come to their *acme* and *decline*; yea, from which the whole Scene of *viſible concretions*, are by a certain ſtrugling from their *central Fires*, brought into *action*, lively pourtray'd upon the Stage of the World.

But becauſe we take an occaſion in our Epiſtle to touch thereon, we ſhall forbear; and at preſent onely add the authority of the intelligent, learned, and worthy *Borichius*, who in his late piece *de Hermetis, Ægyptiorum, & Chymicorum ſapientia*, a tract highly valuable, and worthy the peruſal by all ingenuous perſons) in one place, as if meaſuring forth our *principles*, ſaith to this purpoſe, *viz.* *Nullum animal oſtendi poteſt, ex quo oleum [& hoc eſt animalium Sulphur] educi nequeat; nullum, ex quo nihil aciduli poſſit ſeperari: nulla planta, quæ non vel oleum vehat, vel ſpiritum admoto igne flammantem; nulla, quæ non preſſu ſuccum profundat, ſi ſibi permittatur, in acidum quiddam ſponte abiturum. Metallica ut robuſtioris temperamenti, Sulphure & Mercurio non carent, equidem hoc primum illis cum animalibus & plantis commune eſt, quod rara minera illa ſit, quæ Sulphur verum & flammaturum ſolicite inquirentibus non offerat; nulla, quæ ingenioſe in alkohol tenuata, & aeri, ſi opus eſt, tantillum expoſita, diſtillatione non ſpiritum acidulum expromat.*

p. 413.

Not here to inſiſt on what the learned Dr. *Willis* ſaith in this matter in his Doctrine of *Fermentation*, who as he urgeth, *ob ſalis fluorem* (how rightly let others judge) ſo we, *ob acidi predominium, vinum, lac, ſanguis, cereviſia, edulia prius grata & dulcia, quando corrumpi incipiunt, ingrate aceſcunt.* To which we ſhall add the ſuffrage of the induſtrious *Tachenius* (a conſideration highly worth his own due and well-weighing inſpection) *Lac* (ſaith he) *ſponte aceſſit, ſicut & reliqui ſucci tum vegitabilium quam animalium, cum in putrifactionem tendunt: imo nil putrere neq; generari poteſt novi, niſi præcedat aciditas.*

De Ferm. p. 10.

Hip. Chym. p. 90, 91.

As to the laſt thing propounded in order to the concluding *this diſcourſe*: we might ſay, that *Acids* in order to the *concretions* and *reductions, coagulations* and *liquifications, condenſations* and *rarifactions, ſolidity* and *fluidity*, and other various *modifications* of *bodies*, differently denominated, according to the different impreſſions they make upon our *ſenſual Organs*; I ſay, *Acids* in the *ſolving* the foreſaid appearances of bodies in the main, fall under a double conſideration, *viz.* either as *active* and *fluid*, or *paſſive* and *conſiſtent*.

Under the firſt, *viz.* while its *active*, and ſo its *ſucculent, liquid*, or *fluid*, after which manner it appears in all *actual Fermentations*, whence immediately reſult thoſe grand *diſtinctions* of concrete bodies, known to us under the notion of *animals*, *vegetables*, and *minerals*; which *Fermentation* is previous to all manner of *concretions* in the *triplicity* of *natures workings* (as we have in the foregoing *diſcourſe* briefly illuſtrated) For while *vegetation* amongſt *Plants*, *animation* in the compoſure of *juices*, and thence of the ſtructure of *animal bodies*, and *mineralization* in order to *Hot-Baths*, are perform'd; the *Acids* concern'd, muſt, I ſay, of neceſſity be *fluid* and actually *ſucculent*; otherwiſe a ſtop or lett would immediately be impos'd upon the *workings* of *nature* in the *formations* and *transformations* of bodies, and conſequently would ceaſe to propagate themſelves.

For no growth or accretion of parts in the *geneſis* of *natural bodies* is perform'd, without a *ſucculent Fermentation*, where an *Acid* is in an *actual*, yea *fluid motion*: From which *ſucculency* of *Acids* together with intermediate *coagulations* and *hardenings*, perform'd at due ſeaſons, all concrete bodies in the threefold *Kingdom* of *nature* are produc'd: and from theſe two, *viz. Acids in ſuccis ſolutis*, working upon their *inbred Sulphurs* by a natural *Fermentation*, and from the *concretions* of theſe *juices* by the help of the *ambient Air*, always (in the *generation* of bodies) conſpiring to ſuch effects, I ſay from the *motion* of *liquid acid juices*, and their *weavings* by *concretion* ſeaſonably perform'd, it is, that from very *minute ſeedlings*, Plants are brought on to great bigneſs.

Thus from *Oak-Seedlings*, call'd *Acorns*, (whoſe *ſeminal* part lyeth in a very ſmall and inconſiderable compaſs) may be produced too, and is daily growing to be, great *bulkie Oaks*: So that when we ſee a vaſt ſpreading *Oak*, and look at a ſmall *ſeedling*, whence ſuch in proceſs of time, is produc'd: if we conſider what has been done, and which way *nature* has ſo buſied her ſelf, as to bring forth ſo *diſproportionable* a bulk to the little *plant Embrio* compriz'd in the *ſeedling*: we cannot, I ſay, chuſe but view the *inward agents*, ſet at work in the *epitomiz'd Oak*, in a *fluid ſtate*, which by the expanſive motions of their *juices* in their natural *Fermentative vegetation*, as they come to the *Air*, become thereby woven into Stems and Leaves,, and by further hardenings, are *condenced* and *incruſtated* in part into *Wood* and *Bark*: So that by the concretions of the *Sap* (wherein the *principles* are in a *liquid ſtate* of *Fermentation*) carryed up betwixt the *Bole* and *Bark*, are made conſiderable *increaſe* in *Bulk*, till at length it ſwell to that *huge ſtature*, we ſee many of them grow too.

As to the *bulk* it ſelf of an *Oak*, *Aſh*, &c. it oweth its *original* (as well as all other *concretions* do) materially to *water*: But that water ſhould be *form'd*, *coagulated*, and put on the ſhape of an *Oak*, *Aſh*, &c. that is wholly aſcribable to the *intrinſick agents* or *inteſtine principles* of *Acid* and *Sulphur*, ſet in the *ſeedling* into a *Fermentative motion*, diſplayed into that *figure* by the manuduction and evolution of the contracted and ſhut up *Seed*, carryed up and conveyed by their *proper Veſſels*, whether by the names of *veins*, *arteries*, &c. with their accompanyed *Air Veſſels*, according to the ingenuous *Malpigius*, and our Countreyman Dr. *Grew*. What we have ſaid of an *Oak* is compatible *ſuo modo* to all other *vegetables*.

Then as to the other conſideration *Acids* fall under, in order to the *fabrick of bodies*, whether in the form of *natural* or *artificial concretions*, viz. as it is *paſſive*, or becomes *conſiſtent*, ſo it ſtands in *oppoſition* to *fluidity*, or rather is the complement thereof, determining it into *ſolid bodies*: For we ſee no other cauſe to which *natural concretions*, *coagulations*, *incruſtations*, *conſolidations*, *congelations*, &c. comprized under the *notion* of *binders* up of *bodies*, can or ought to be more genuinely refer'd then to *Acids*, under this conſideration: what I pray are *Stalks*, *Leaves*, *Husks*, *Grains*, &c. of *Plants* or leſſer *vegetables*, but the *Aci-*

dum woven and condenc'd (with ſome *Sulphurous* parts) into thoſe *forms* by the *acceſs* of *Air*? what are the *bole*, *bark*, and *branches* of *Trees*, or larger ſiz'd *vegetables*, but the *concretions* and *hardenings* of the *native Acid juices*, together with the incloſure of ſome *Sulphurous* parts, by the co-operation of *external Air*? what the *Fruits* of *Trees*, but the *coagulations* of *Acids*, ſweetened by their *Sulphurs*, thereby brought on to *maturity*, and thence made fit for other *Fermentations*, in order to *potable Liquors*?

What, amongſt *animals*, is fleſh and muſculous parts, but the *coagulation* of the *blood* and other humours, to whoſe *conſtitution* a genuine *Acidum* in a due proportion is *eſſentially requiſite*? What the *Bones*, but parts *conſolidated* from implanted *Acids*, in whoſe *coagulation* or *condenſation*, ſome *Sulphurous* parts are alſo taken in? And as in the natural conſtitution of the *body*, and *eucraſie* of the *humours*, *Acids* are chiefly concern'd in the *concretions*, *coagulations* and *conſolidations* of the parts; ſo likewiſe in the *dycraſie* of *animal juices*, and *preternatural concretions* and *indurations*, &c. of the body, *Acids* are primarily concern'd: Thus what are *Fiſtula's*, but *calloſity* and obdurate hardneſs of the inward parts, *viz.* the *veins*, *arteries*, &c. being hardened by a ſpurious *Acidum* lodg'd in thoſe particular parts? What are the *podagrical Tophi* and *Nodi*, but the *Synovia* of the *Joints*, hardened and congealed by a *gouty Acidum*, fixing it ſelf by *coagulation* upon thoſe parts? What are *hard tumours*, but ſwellings from *Scorbutick Acids*, or from *Acids* of ſome badly cured *Diſeaſe*, lurking in its *Acid ſeminary* for a time, till other concurring cauſes ſets the *ſpurious Ferment* more awork, and by the predominant *Acidum* (the general *faber* of pains and dolours) the Veſſels are obſtructed, and the *humours* of ſome particular parts *coagulated* into thoſe *obdurate ſwellings*. Laſtly, What is the *Stone* in the *Gaul*, *Bladder*, or other parts of a *humane*, or other *animal body*, but chiefly an *Acidum* fixed upon a *petrifick Earth*, and *urinous Alcali* or *volatile Salt*, taking in ſome *Sulphurous parts*, but eſpcially, as I ſay, bound up, or knit together by the *vinculum* of an *Acid*: Of which, further in our *Lithologia Phyſica*.

Amongſt *Minerals*, What are all *foſſil* and other *mineral Salts*, but *concretions* chiefly perform'd by the power of *Acids* in the bowels of the *Earth*? In particular, what are *Sal marine*, *Vitriol*, *Alom* and *Nitre*, but *concretions* of *acid juices*? And indeed what are the generality of *artificial Salts*, or ſuch as are made by *mixture*, but ſuch in whoſe texture *Acids* are chiefly and primarily *concern'd*, and without which ſcarce any ſaline concretion at all doth appear? What are *Stones* made in the bowels of the *Earth*, but *liquid* ſubterraneal *juices* of *alcalizate*, or other proper matter, arreſted by *acid ſteams*, ariſing from ſome *Fermentation* of *mineral juices*, which together paſs into thoſe *petrifick* concretions; as we ſufficiently (and that *de induſtria*) demonſtrate in our *Lithologia Phyſica* and *Halologia Chymica*.

What are *Minerals* themſelves (being *immature Metals*, having the *principles* of *Metals* but after a *crude*, *volatile*, imperfect *manner*) ſuch as *Brimſtone*, *Antimony*, *Pyrites*, *Auripigmentum*, &c. but Sulphurous concretions, bound up by their *intrinſick acids*, taking into their compage other *Heterogenities*, as we have in ſhort above declared, and may more at large, God willing, in another place. Yea, to go higher, what are the *Metals*, but a *metallick Sulphur*, bound up by a peculiar implanted *Acidum*, in the mercurial *juices*, whoſe mixture being not perfect, through a *complication* of ſome *heterogenities*, makes the imperfect, but thoſe being removed by a cloſer bond of the *metallick principles*, gives the perfect *Metals*, unſeparable and unalterable by the power of the ſtrongeſt culinary *Fire*.

We might go yet further, and ask what is the *Philoſophers Elixir*, (if ſuch there be *in* *rerum natura*) but ſuch a cloſe weaving of *metallick principles*, (whoſe *Acidum* is intimately and inſeparably *united*) all ſo highly *graduated*, as to become a *fixt coagulated tincture*, of ſo extenſive a *nature*, as to be able to make *quick tranſits* through, and thereby to hinge into its own *fixity* and *purity*, other *imperfect metallick bodies* ?

So that upon a ſerious inquiry with our Eye directly levelled into the *works* of *nature*, we cannot but conclude ; Firſt, That all manner of *coagulations*, *congelations*, *condenſations*, *ſalifications*, *petrifications*, yea all ſorts of *concretions* of *bodies* (or of *juices* into *bodies*) are primarily aſcribable to *Acids*, as their grand *faber*, of which we diſcourſe largely, and demonſtrate (we think) clearly in our two foreſaid Tracts. Secondly, That by theſe foreſaid *coagulations* , *ſalifications*, *petrifications*, and other *concretions*, the *connate Acidum* doth ſo combine with the *Sulphurous parts* it cloſeth with, as that both paſs into a *quid tertium*, or neutral reſult, partaking of both, and yet diſtinguiſhable by neither : inſomuch as the *Acidum* by ſuch ſort of *coagulations* and *concretions*, looſeth its Sting, and becomes thereby altogether unperceptable : And hence is the reaſon why although *Acids* be the very *foundation* of all *coagulations* & other *concretions* of *bodies*, yet are themſelves, as to our guſt, in many things the leaſt diſcoverable; which becauſe we cannot eaſily get to the inſides of bodies in their natural productions, ſhall therefore endeavour to *demonſtrate* and *elluſtrate* by *artificial mixtures*, reſembling the *natural.*

Thus in mixing the *Runnet* or uſual *Ferment* to *New-Milk* upon *heat*, or while warm after Milking, the *acidity* of the *Runnet*, not only makes the *Milk* ſplit into *Curds* and *Whey*, but is it ſelf ſo *coagulated* with the Curds, as not to become perceptable at all: ſo that *Cheeſe* is nothing elſe but a *neutrum*, or *neutral reſult* from an *Acid*, and curdling parts of *Milk*, coagulated together, while *Cream* is the *Sulphurous* parts of *Milk*; and *Butter* is the *coagulum* of that *Cream*, ſeparated by a ſlender *Fermentation* procured by the motion of *Churming*; which very *coagulation* of *Butter* is from a combination of ſome ſmall quantity of *Acidum* with the *Sulphurous parts.*

Thus alſo from the *Acidum* in *Wines* (of all ſorts) in *Ale*, *Beer*, *Syder*, &c. being poured upon warm or boiled *Milk*; from the *Acidum*, I ſay, in any of the foreſaid *Liquors* it is, that the *Milk* ſeparateth into *Curds* and *Whey*, or *poſſet-drink*; the former of which are made lighter or ſtiffer, according to the difference of the *Acids*, and various manner of application of the *ingredients*; in which Curds, the *acidum* of the *Fermentable Liquor* is wholly *coagulated*, which is a good way of mortifying or correcting all ſorts of *fretting Acids*, whether in bad *Wines*, or other *Liquors*, which all fix (if there be *Milk* enough) in the *Curd*: and yet that *Curd* is a neutral, and the *Acid* not at all perceptable therein; yea in caſe of *bad Wines* or other *Drinks*, where the *Acedum* is too *eager* and *fretting*, to thoſe who do not care for *Poſſet-drink*, and yet would not looſe their *Wines*, or other *Liquors*, I would (being prompted from the foreſaid cauſe) propound as an expedient, to put a ſpoonful or two of *boyling Milk* upon a Pint or Quart of ſuch ſort of *Liquors*, ſtir it about, if the *Curd* riſe to the top to *skim* it off; if not to run it through a *filter*, whereby it will become *clear*: and ſo you have corrected your *Wines*, &c. and made them fit for *drinking*, or in lieu of that to put a *toſt* of old Wheat bread therein, which will imbibe much of the *ſuperfluous Acidum*, and make the *Drink* thereby more wholſome.

From the foreſaid cauſe of *Acids* it is alſo, that Fat congeals in *animals*, which is but the *Sulphur* of the *blood congealed* by its own, or at leaſt acquired *Acidum* of the *Air*: which after melting by *heat*, (whereby the *Acid* becomes *fluid*) congeals again in cold, into that conſiſtence called *Saem* or *Tallow*; and from the *facile congelation* of the *Sulphurous parts* of the *blood* in ſome animals, from the *acidum* under either or both conſiderations, *viz.* of native, or acquired from the *Air*, it is, that for inſtance *Conies* and *Field-fare*, become *Fatter* in Froſty weather: and from the like cauſe, the Fat of *Land-animals* is hard (as the ingenuous Dr. *Grew* notes in his *diſcourſe* of mixture) while that of *Fiſh* is very ſoft, and in great part *runs* to *Oyle*, viz. becauſe the firſt ſort are expos'd to the *acidum* floating in the *Air*, and thereby continually (to proper ends) inſpired: and the latter, being always *immers'd* in *water*, is much what depriv'd of that congealing *aereal acidum*.

And as *Acids* are remarkable in the various *concretions* of *animals*, viz. in the coagulations into *Fleſh*, conſolidations into *Bones*, congelations into *Fat*, &c. whereby they ſhew their different operations upon various *juices* of *animal bodies*; and thereby alſo combine into neutral reſults as aforeſaid: ſo likewiſe, the ſame is evident amongſt *vegetables*: Thus expreſs'd *Oyles*, eſpecially when the *innate acidum* ſo prevails by ſome *acquirements* from the *aereal*, do by keeping, grow *rancid* and *thick*; as alſo is further apparent in the mixture of *acid* Spirit of *Nitre*, with *Oyle Olive*; whereby the vegetable Oyle is *coagulated*, and made *conſiſtent*, being congealed thereby into a *white Fat* or *Butter* (as Dr. *Grew* obſerveth.)

And as *nature* produceth *Roſins* and *Gums* in Plants and Trees, congealing the *juices* of wounded *Stems*, *Boles*, *Stalks*, *Heads*, &c. by the *acidum* of the *Air*, according to the diſpoſition and genius of the Plants, whence *Roſins*, as of *Turpentine Scamony*, &c. *Gums*, as *Camphire*, *Opium*, &c. ſo in like manner *Art* in imitation of *Nature*, and from the ſame *principles*, can produce ſomewhat equivalent thereto: Thus if the *acid Oyle* of *Vitriol* be mixed with the *Oyle* of *Aniſe-ſeeds*, the *vegetable Oyle* is immediately (by the *acidum* in the *mineral diſtill'd Liquor*) congeal'd into a perfect *Roſin*.

Yea, and by the addition of *Acids* to ſome *vegetable Oyles*, may be reſembled the production of *Turpentines*: Thus *Oyle* of *Vitriol* added to the diſtill'd *Oyles* of *Turpentine*, *Nutmegs*, *Juniper*, &c. after *Fermentation* become of a conſiſtence altogether emulating uſual *Turpentine*, without the leaſt appearance of *Oyle* ſwiming on them; nay, although Spirit of *Wine* be afterwards added, yet will it cauſe no *ſeparation* of any of the *Oyle*: But the contrary happens, if you add *Spirit* of *Wine* to an *eſſential Oyle*, before mixture with the *Oyle* of *Vitriol*; for then the *Spirit* of *Wine* and *Oyle* of *Vitriol* unite, and reject the eſſential *Oyle* to the *ſuperficies*: So that the reaſon why diſtill'd *Oyles* by the foreſaid artifice, ſubſide in the form of a *liquid Turpentine*, is becauſe, that upon *Fermentation* from the foreſaid mixture, the *Oyles* receive ſuch an alteration, by ſuffering their *volatile parts* to go off, as that what remains, combining with the *Acidum* of the *Vitriol*, becomes thence more a *Turpentine* then an *Oyle*, and conſequently, as heavier, muſt ſubſide, although *Spirit* of *Wine* be put thereto, which otherwiſe would *ſwim* above it.

So that from the premiſſes it will naturally follow, that *Turpentines* are indeed but *liquid Roſins*; and *Roſins*, no other then concrete *Turpentines*, and further, that *Turpentines* are *Oyles* incraſſated or condenced by addition of *Acids*: yea all, but ſeveral diſguiſes of *Sulphur*, altered according to different degrees of *Acids*, and their various aſſaults upon *Sulphurs*.

Its worth (by the by) our *obſervation*, that even from the mixture of ſome *Acids* and *Sulphurs*, ſanguification (I mean as to its *tincture*) may as well be imitated and ſhadowed forth unto us, as from thoſe of *volatile Alcalies* and *Sulphurs*: Thus the *acid Oyle* of *Vitriol*, mixed with the *eſſential Oyles*, either of *Turpentine*, *Juniper*, *Nutmegs*, or *Amber*, *Strikes* (beſides the *Fermentation* and intenſe heat they cauſe) a deep *blood red colour*, as I have tryed; And I do not know yet, but that even *Alcalies*, whether *fixt* or *volatile*, may from the ſame reaſon of their hidden and ſhut up *Acids*, intend the *colours* of Sulphurous *vegetables*: concerning which *Acids* we elſewhere touch: yea, and from the ſame operation of the genuine *Acids* upon their proper *Sulphurs*, in the great work of *vegetative Fermentation*, are ſtruck thoſe various, and no leſs *admirable colours*, in the great field of *vegetables*, as we have hinted before.

And to conclude, as we have ſhewed *water* to be the *material principle* of all *concretions*: ſo the *diſtinction* and *ſpecification* thereof, depends upon *Fires* or *Ferments*, lodg'd and hid in the inwards of *Seeds*: which *Fires* or *Ferments* are differenced from the great variety, chiefly of *Acids*, not onely in *Fermentation*, but *Concretion*, in *Fluidity* but *Solidity*, and conſiſtency of bodies: For whats the *tapeſtrey* of *vegetables*, in their peculiar verdure, ſpangled with an *amicable luſtre*, but ſo many *central Fires* or *Ferments*, at firſt hid in their *ſeminals*, and afterwards by the co-operation of other conſpiring cauſes, diſplayed into almoſt infinitely variety of *Plants*, branching themſelves in their different, delicate, and beautiful *colours*? And what are *animals*, but *vital Lamps* burning in *bodies*; and yet thoſe bodies no otherwiſe conſum'd, but by the glowing, dwindling, and at laſt extinguiſhing of thoſe *vital tapers?* whereby not onely *animals*, but alſo *vegetables* are apt (beſides their common putrilage from plenty of moiſture) to ſpend themſelves (by the declining of the foreſaid *Ferments*) in *hecticks* and wearing *maraſmes*, which *vital Ferments* are more noble then the *vegetable*, becauſe working in greater varieties of Veſſels, and therefore the more highly by *circulation*, ſublim'd and graduated into *animal Spirits*, the ultimate product of *vital Ferments*, yea in humane bodies is the very *vinculum* of the *rational Soul* (that Heaven born Creature) to the body, being its *vehicle*: here a large Field is open, where I could freely let my thoughts and pen run; but ſhall at preſent ſet up my ſtaff, and content my ſelf (although unwilling) in drawing the Curtaine over the reſt, and indeed at length, after many concluſions, make an End.

FINIS.

This following Paragraph is to be inſerted inſtead of that in page 11. line 29.

HEnce it is, that ſome of thoſe *Sulphurous-hot-waters*, may with good ſucceſs, in order to the *Cure* of ſome *Diſeaſes*, be taken inwardly, others not; Thoſe that may, are generally ſuch, whoſe *Sulphurs* are either from *Common Brimſtone*, *Vitriol*, or *Antimony*. or from *Marcaſites* and *Pyrites* bordering thereon: of which ſort (among the reſt) are thoſe of the *Bath* in *Somerſet-ſhire*, which take their *original* from ſuch kind of *Minerals*, or *Mineral juices*, lodg'd in the *bowels* of thoſe great *Mountains*, at the *foot* or *centre* whereof thoſe *Baths* break forth; which although of late are found to be *ſucceſsful* in the Cure of *ſome Diſeaſes*; yet its very *ſuſpicious*, they injure other perſons, who, without good advice, *drink* thoſe *waters*; ſo that as to a univerſally medicinal water, they come far ſhort of the *Sulphur-water* at *Knarsbrough* in *Yorkſhire*. And indeed theſe *hot-Sulphur-Bath-waters*, ought to be *drunk* with a great deal of *caution*, and but by ſome *perſons*, and that too in *extraordinary caſes*, yea in no wiſe to be *drunk* as a general *healing water.* Thoſe *Sulphurous hot-waters*, which are altogether improper for *inward uſe*, are ſuch as are impregnate with the *Sulphurs* of *Bitumen*, *Arſneck*, *Riſogalla*, &c. or with the *Minera's* thereof, or at leaſt with ſuch *Marcaſites* as participate therewith, they are ſuch as we elſewhere name. Now the *acidum* which neceſſarily concurs to thoſe *Fermentations*, as an indiſpenſible *Sulphur*, opens the bodies of thoſe *Sulphurs*, and thereby either detains them while *in fieri*, *in ſuccis ſolutis*, or from concretions reduce them to ſuch; by either way, renders ſome wholſome and healing, others noxious for inward uſe, according to the difference of the foreſaid *Sulphurs*.

An *Advertiſement* to the *Reader.*

T*Here is now publiſhed a Second Part of the* Catalogue *of* Chymical Books *in Engliſh, to be added to the Firſt Part, formerly Printed with the* Philoſophical Epitaph, *together with a Third Part of the* Chymical Catalogue, *or a Collection of ſuch things publiſhed in the* Philoſophical Tranſactions *of the* Royal Society, *as belong any way to* Chymiſtry, *or the ſtudy of Nature by Art in the* Animal, Vegetal *and* Mineral Kingdoms; *which* Catalogues, *with moſt of the Books contained in them, (with many others of that Subject in Latin, a large account of which* Borellus *hath given in his* Bibliotheca Chymica) *are to be Sold by* William Cooper *at the* Pellican *in* Little-Britain, *London.*

A

DISCOURSE

OF THE

Sulphur-Bath

AT

KNARSBROUGH

IN

YORK-SHIRE.

BY

WILL. SIMPSON, *M. D.*

LONDON,

Printed for *Will. Cooper* at the *Pellican*
in *Little-Britain*, 1675.

A Diſcourſe of the Sulphur-Bath *at* Knarsbrough, *concerning its Cauſes and Virtues.*

THat I may not be injurious to what I have already writ in my two former Books, entituled *Hydrologia Chymica* and *Hydrological Eſſays*, concerning the *Sulphur-Well* at *Knarsbrough*, as a *mineral water* of great uſe in its virtues inwardly taken. But now deſigning an account thereof, as a *Bath* for outward uſe, ſhall therefore, in order to the better underſtanding of what I aim at, here reſume ſo much of my former *diſcourſe*, concerning the *Eſſential ingredients*, and *neceſſary principles* of that *Water*; together with an addition of ſome more recent *obſervations*, as may ſerve to illuſtrate what I now intend to be my preſent task: Our method will be as followeth.

1. To lay down the conſtitutive ingredients or *mineral principles* of that *Water.*

2. To ſhew the proceſs (as near as we can apprehend) *Nature* uſeth in the preparing this *excellent water.*

3. To ſhew the difference betwixt this and other natnral *Hot-Baths*, as in their original and inbred *principles* ; ſo alſo in ſome ſort as to their virtues.

4. To ſhew how, and by what means, the *Sulphur* (as the chief *mineral ingredient* in this water) is ſo opened, as to become, not only ſo ſubtile, as thence to be ſolvable *odore tenus* therein; but alſo ſo *volatile*, as to paſs off in a continual *ſteame*, and inſenſible *effluvium.*

5. How this *Sulphur-water* comes not much ſhort, as to its *original principles*, nor is much (if at all) inferiour in its efficacy, to ſome other *Sulphur-waters*, which are *Hot-Baths* ; inaſmuch as this is lately found to be *ſucceſsful* for *outward applications*, as well as thoſe by late *obſervation* are remark'd for inward uſe.

6. To ſhew, that the artificial heating of the *Sulphur-water*, bears ſome analogy to the *inbred heat* of other *Baths*, as they come hot out of the Earth.

7. To ſhew, how *Art* may imitate *Nature*, (but yet from the ſame *principles*) in the reſemblance of moſt *Baths*, *viz.* how to prepare ſuch *Baths* artificially, as are natural.

Laſtly, To inquire how and after what manner this *Sulphur-water* performs thoſe expected helps, as a *Bath:* where, in ſhort, will be *illuſtrated* its various virtues in order to the help of ſeveral *Maladies.*

Firſt, As to the conſtituent ingredients or *mineral principles* of this *water:* We ſay they are compriz'd in theſe three, *viz.* 1. A *marine* or *foſſil Salt.* 2. A *Sulphurous Apporrhea* or *ſteam* of *Sulphur.* Laſtly, A little *aluminous acidity.* As to the firſt, viz. *Salt*, is apparent both from its brackiſh taſte, as alſo from what *remains* upon its *diſtillation* or *evaporation*; of which we find betwixt one and two drams in a quart thereof: as we further ſhew in our *Hydrologia Chymica*, &c.

2. As to the *Sulphrous principle*, thats manifeſt, 1. From its Taſte and Smell; as alſo from its hogo upon the *riſings* and *regurgitations* of the Stomack, after taking thereof. 2. From its colouring of *Silver* dipt therein; which it doth as readily as the ſolution or waſhings of *crocus metallorum* from the *Sulphur* of the *Antimony*; or as the ſolution of *common Brimſtone* in the preparing *Lac Sulphuris*, both being made from the *Acids* of *alcalizate Salts*, as will appear (although a paradox) more clearly anon.

And laſtly, from its *colouring* of *Silver* by its very *Steams*, as we ſhall ſhew more afterwards.

Now the queſtion may be ask'd, whence this *mineral water* has its *Sulphur*? I anſwer, that there are plenty of *vitriolin Marcaſites* well ſaturate with *Sulphur*, out of which I have, by an artifice (taught in my *Hydrological Eſſays*) ſeparated perfect *Brimſtone*, which melted into *magdalions* or *rolls*, are not diſtinguiſhable any manner of way from the common: beſides which *Marcaſites* (found not far off this Spring) the very adjacent *Earth* is full of *Brimſtone*.

Laſtly, As to the ingredient of *Alom*, its diſcoverable theſe ways following, firſt from the *Alom-Bed* through which this *water* at laſt paſſeth, or at leaſt toucheth upon, as is obvious to any eye that will look at it, being cloſe adjoyning to the *exit* of the *water*.

2. By its *acidity* in the *water*, as is evident from its *curdling* of *Milk*: for the *Salt* ſeparated from the *Sulphur-water*, being put into boyling *Milk*, will make it ſhil into *Curds* and *Whey*, as if ſome *acidum* was poured thereto, which *common Salt* will not do; for we try'd both, and that in the ſame proportion, and found the *Sulphur Salt* to cauſe a ſpeedy *ſeparation*, and that in great quantity; and the common Salt made a little *ſeparation*, of a *lighter coagulum*, but did not make it ſhil, or alter the ſeeming colour or conſiſtence of the *Milk*: And laſtly, if the powder of *Coral* or

Crabs-Eyes be put thereto, they imbibe or mortifie the *acidity* of the *Alom*, and cauſe a *Milkieneſs* from the *volatile Sulphur*.

And as the three aforeſaid ingredients are found to be the *conſtitutive principles* of this *water*, ſo that neither *vitriol* nor *nitre* (however ſome imagine the contrary) are contain'd therein, is evident, firſt as to *vitriol* (which gives the moſt ſuſpition from the plenty of its *Marcaſites*, found not far from the *Well*) becauſe it will ſtrike no *tincture* with *Galls*, as we ſhall ſhortly further evince: And as to *Nitre*, there is not the leaſt ſuſpition, either from what is *ſeparable* from the *water*, nor from any *mineral glebe* adjacent thereto, that we have yet diſcovered.

Secondly, As to the proceſs *Nature* uſeth in the preparing this excellent *mineral water*, or the manner of her mixing the foreſaid ingredients, by her *Chymiſtry* in the bowels of the *Earth*, in order to the making up the forenamed *Sulphur-Bath*: In ſhort thus, a *water Spring*, ſuppoſe, paſſing through or by a *minera* of *foſſil Salt*, part of which it diſſolves, and afterwards in its current either *meeting* with ſome *acid juice*, whether of *vitriol* or of other *mineral glebes*, becomes impregnate therewith, and obviating, or rather ſupervening a *Sulphurous Mineral*, from the concourſe of which two, happens a *Fermentation*: or elſe, this Saline Solution comes upon a *minera*, whether that of *vitriol*, or what other ſoever it be, in the *meanders* of the *Earth*, whoſe *principles* are yet *crude*, and onely *embrionative*; whereupon it ſets thoſe native and congenit *principles* awork, into a *Fermentation*, either way, I ſay, it becomes capable of raiſing that inteſtine motion, we call *Fermentation*, and thence of ſo ſubtilizing and volatizing the *Sulphur*, as to make it ſolvable in *water*, (as we have illuſtrated more demonſtrably above in our *Doctrine* of *Hot-Baths*.) But not ſtaying here, becauſe of the continual afflux and preſſure of *water*, at length it paſſeth through an *Alom-bed*, whoſe *acidity* precipitates in great part the body of the *diſſolv'd Sulphur*; in which very *precipitation* happens its fœtid ſmell, and *Sulphurous hogo*, which onely paſſing through a ſlender *Colander* of Sand, retains its lately contracted odour; where it filters off from the more *groſs* precipitated *body*, and ſo makes its *exit*.

Which gives great probability of *heat* in the ſource of its *original mixture*, and that if the *Spring* did immediately after that *Solution* and *Fermentation* break forth, it would be *hot*, at leaſt *warm*, after the manner of other *Hot-Baths*; but being carryed on in a longer line, in its *ſubterraneal current*, before it breaks forth, *looſeth* that *heat* contracted upon the *Fer-*

Fermentation of the aforeſaid *mineral juices.*

And this is likewiſe remarkable concerning *Alom intereſted* in the fabrick of this *water*, *viz.* that I have (as often as I pleas'd to make the experiment) taken ſome of the *ſucculent Alom* ſlate or ſtone (found cloſe by the *Well*) which has had the *Salt* diſcernably extraverted, which when I *ſcrap'd* into ſimple *water*, would with *Galls* forthwith *ſtrike* a deep *Purple*: after the manner which the ſucculent *Alom-ſtone* doth, which is got upon the *Starbrough Bank*, near that *Spaw* [about which our great controverſie, concerning that *waters* being *aluminous*, and not *vitriolin*, did chiefly depend] which experiment I have ſeveral times ſhewed to *perſons* no leſs *ingenious* then *inquiſitive.*

I alſo order'd an infuſion to be made of ſome of the ſame *Alom-ſtones* in above a Gallon of *freſh water*, then to be *evaporated* to about half a Pint, which filtred, I evaporated further in *Balneo M.* to try if it would ſhoot *per ſe*, but it would not, onely came to a ſoft ſort of *matter* or *mellago.*

3. As to the third thing propounded, *viz.* the difference betwixt this and other natural *Hot-Baths* in their *original principles*, and *primary cauſes*: We think that from what has already been ſaid, and eſpecially what yet remains to be diſcours'd of, in the next, and

other *ſucceeding propoſals*, that the difference of theſe from other *Sulphurous waters*, both as to their *origin* and *virtues*, will ſufficiently be declared: And that *Sulphur* (of one ſort or other) is *chiefly concern'd* in the fabrick of all *Hot-Baths*, and other *Sulphurous waters*, compleating with other *concurring juices*, the eſſence of them both.

4. As to the fourth propoſal, *viz.* how, and by what means, the *Sulphur* (as the chief *mineral ingredient* in this *water*) is ſo *opened*, as to become, not onely ſo *ſubtile*, as thence to be ſolvable *odore tenus*, but alſo ſo *volatile*, as to paſs off in a *continual ſteam*, and *inſenſible effluvium*; For the great query is, how *Sulphur* may be ſo opened, as to make the *Sulphur-well*, and other *Sulphurous waters* of the like nature.

While I was therefore ſeriouſly ruminating upon this matter, *viz.* what it was that might truly be ſaid to *open* the *body* of *crude Sulphur*, whether it was an *Acid* or an *Alcali*, I began to conſider how many *ways*, and by what *means*, it was uſually ſo *opened*, as to make a *ſolution* in any *Liquor*: Firſt I conſidered it was *ſolvable* for the moſt part in all *Oyles*, by the help of *Fire*: and that I imagin'd happened from the analogy of parts, betwixt *Oyles* and *Sulphurs*; both of them being chiefly *Sulphurs* under a *diſguiſe*, the one in a *concrete*, the other in a *liquid form*; both of them alſo in their *bellies* hiding their *intrinſick Acids*, the *Oylie* or *Sulphurous parts* of both by *Fire* melting together, in the *fluid form* of a *Balſome*, while the *acidum*, chiefly of the *Sulphur*, being thereby in part *ſeparated*, doth *concreſcere* into a *ſaline form*, under the appearance of *cryſtals*, as is obvious in the preparing the *Balſome* of *mineral Sulphur* or *Brimſtone*.

And as *vinous Spirits* are *vegetable Sulphurs*, comminuted and ſubtiliz'd by *Fermentation*; ſo theſe are alſo *ſuccedaneous* to *Oyles*, in the ſolutions of *Brimſtone*, yet need previous preparations by *fixt Alcalies*, (as they are called) for being ſo *ſpiritualiz'd*, are not ſuch apt *menſtrua* for ſolutions of *crude Minerals*, as *Oyles* are, although either of them are powerful enough for making very ſtrong and furious *Fermentations* with the aforeſaid *mineral Sulphurs*, once by their *congenial Acids*, brought, by help of *Fire*, into a *fluor*, in the form of *corroſive menſtrua*: witneſs the high ebullitions betwixt *vinous Spirits* or *Oyles*, and *Spirit* of *Nitre*, *Aqua-fortis*, *Oyle* of *Vitriol*, &c. ſome of them ſo very furious in their *Fermentation*, as to ariſe to an *actual flagration* (as we elſewhere demonſtrate.)

So that *crude Sulphurs*, unopened by the acuations of the *acidum* of *Fire*, (which alſo ſharpen the implanted *Acids* of ſuch *Minerals*) do *diſſolve* quietly without any tumult; (if done leaſurely) and melt together into one *Balſamick Liquor*, (though if haſtily done with a pretty *ſmart Fire*, they make a *crackling noiſe*) whereas the foreſaid *mineral Sulphurs* being *ſubtiliz'd* by their own *Acids*, fortified by the *acidum* of *Fire*, in their *diſtillation*, are brought thereby into a *fluor* of both *principles*, and if then mixed with the foreſaid *vegetable Sulphurs*, contract a furious *Fermentation*, from the freſh *colliſions*, betwixt *Acids* and *Sulphurs*, and if cloſe ſhut up, would break in pieces the ſtrongeſt Veſſels art could contrive.

And as the foreſaid ſolutions of *mineral Sulphurs*, are perform'd by *Oyles* and *vinous Spirits*, from analogy of parts ; I conſidered whether other ſorts of ſolutions of *crude Brimſtone*, or the like *Sulphurous Minerals*, might not alſo be done, by the like analogy, and then I pondered upon the *alterations* made upon *Brimſtone*, &c. by *fixt alcalies* (which how properly call'd, we ſhew in our *Halologia*) and *quick-lime*, and by well weighing the matter, found, that as *Brimſtone* was diſſolvable in *Oyle* and *Spirit* of *Wine*, as aforeſaid, ſo *fixt alcalies* work upon *Sulphurs*, no otherwiſe then as they are *acido-ſulphurous Salts*.

For I conſidered that *volatile Alcalies,* ſuch as are all *urinous Spirits,* work not at all upon, nor cauſe any alteration in *Sulphurs :* therefore it muſt needs follow, that wherein *fixt* and *volatile alcalies* do agree, or in that property, which is common to them both, I mean, their *precipitating faculty,* neither of them is concern'd in the *ſolutions* of *Brimſtone,* and that is common, both to *fixt* and *volatile Alcalies,* to precipitate, what *Acids* have diſſolv'd. Now the reaſon why *urinous* Spirits, I mean *volatile Alcalies* (as they are call'd) do not at all work upon *BrimStone,* is, becauſe they contain ſo very ſlender a texture of *Acids,* and no *Sulphurs* (if highly rectified) and therefore are incapable by analogy of working upon the aforeſaid *bodies :* how fixt *Alcalies* are a new *compage* of their own native *Acids* and *Sulphurs,* together with the intertexture of *urinous* Spirits, (from whence proceeds its precipitating faculty) all bound up by the *acidum* of the *Fire,* (which is their *vinculum*) and not a *ſimple* Salt, we elſewhere in our *HiStory* of *Tartar,* declare more at large.

While I was pondering upon this matter, at length methought I eſpyed a great *harmony* in *natures works ;* I ſaw that ſhe perform'd the ſame *ſolutions* of *mineral* Sulphurs, in ſome parts of the *bowels* of the *Earth,* by her own *men-*

ſtrua of *Acids*, prepared by her dextrous *Art* of *Chymiſtry* (the very foundation and exemplar of all we call *Artificial*) as ſhe did in other actions, reputed (amongſt moſt Authors) *Heteroclites*; and was the ſame in the latter, as the former; and from hence I ſaw, that reputed *cauſticks*, I mean *fixt lixivial Alcalies*, were no other then *Acids*, viz. of the *Fire*, fixt upon bodies: ſo that I found *nature ſymbolical* in all her *actions*, and always conſonant to her own *principles*.

And that I might *improve* this *notion* the better, (not taken notice of by any other Author I know) I began to make a *ſtrict ſcrutiny* into the *nature* of *fixt Alcalies*; I conſidered, Firſt, That the more *Fire* they endured, and the *higher* they were *calcin'd*, and the ſooner us'd after *calcination*, the *ſtronger* and more *fiery Cauſticks* they were.

2. That they would never *calcine* to a ſtrong *Salt*, unleſs perform'd in *open Veſſels* or *Crucibles*, where the *Fire* might more immediately touch upon them, and *concentre* its own *acidum*.

3. That if after they were *cold*, and kept from the *Air*, and then *Spirit* of *Wine* or *Water* was put thereto; thence a *heat* was preſently *produc'd*, which as I conceive, was from no other cauſe then this, *viz.* That either of thoſe *Liquors*, ſets the *acidum*, contracted from the *Fire*, and the *Sulphur* or *volatile Alcaly*

in the *Salt*, into a ſudden *Fermentation*, diſſolving, and ſo putting them into an *inteſtine colliſion.*

4. And fourthly I conſidered, That the longer theſe *Salts* were expos'd to the *Air*, even to a ſolution *per deliquium*, the more mild and ſoft in operation they become; *looſing* thereby gradually their *Acids* imbibed from the *Fire*; inſomuch as by often ſolution *per deliquium*, the *compage* of that *Salt*, from the *vinculum* of the *fiery Acid*, is taken off, as that the whole may thence be *reduc'd* into an *inſipid Water* and *Earth* (and no *Arcanum* neither.)

Laſtly, That although theſe fixt *lixivial Salts*, do make ſtrong *Ebullitions* with *Acids* put to them, yet that happens, either betwixt the additional *acid*, and the *Sulphur* in the *Salt*, or betwixt it, and the *volatile alcaly*, bound up in the *artificial concretion*: That there are *Sulphurs* in thoſe *Salts*, or new textures of Plants, appears from their *lixivial* or *ſaponary* property: and that there are alſo *volatile alcalies*, is evident from their precipitating faculty, and from their *inteſtine ſtrugling* with *acids.*

To which may be added this *obſervation*, that after *fixt alcalies* have loſt the *acidum* contracted from *Fire*, (which they do by keeping, and ſometimes expoſing to the *air*, together with the addition of ſomewhat which dints the foreſaid *Acidum*) may then by Art, be made to ſplit into *Oyle* and *urinous Spirit*, or *volatile Salt.*

As to that great objection againſt the *acidity* of *fixt lixivial Alcalies*, viz. the precipitation of ſuch ſolutions made with *Alcalies* by *Acids*, inaſmuch as it is generally obſerv'd, that what ſolutions *Alcalies* make, are moſt promptly *precipitated* by *Acids.* I anſwer, Firſt, That although what more ſimple, I mean, *volatile Alcalies* do diſſolve, are precipitated very readily by *Acids*, *& vice verſa*, yet where *Alcalies* are more complicated, and interwoven with other eſſential parts,there the *precipitation* by *Acids*, of what thoſe already have diſſolv'd, are in no wiſe wholly aſcribable to them as *alcalies*, but equally compitible to other parts in the concretion.

And in the next place I anſwer, that even ſome *acids* are capable of *precipitating* what others have *diſſolv'd* ; to prove and illuſtrate which, I try'd this following inſtance, *viz.* I took a clear ſolution of *ſaccharum Saturni*, which I had prepared with *diſtilled Vinegar*, which no man will deny to be an *Acid* ; upon which I poured a pretty ſmart *Spirit* of *Vitriol*, whereupon it preſently became *Milkie*, and caus'd a *precipitation* of a pure *white calx* of *Saturn*, which *precipitation* may alſo be done with *Spirit* of *Salt*.

The ſame likewiſe will *Spirit* of *Salt* do, poured upon a ſolution of *refin'd Silver*, made in double its weight of *Aqua fortis*, in preparing that admirable anomolous neutral concretion, call'd *Luna Cornea*, mentioned by the *honorable Boyle* in his *origin* of *forms* : and not onely *Spirit* of *Salt* but alſo *Oyle* of *Vitriol* will cauſe the like *precipitation*.

Whence its obvious to any eye, that what ſome *Acids* diſſolve, others may precipitate from the *congenealneſs* of the *ſolvend*, to one *ſolvend* more then another: For both thoſe wherein the *ſolutions* of the *metals* were made, viz. *Spirit* of *Vinegar* and *Aqua-fortis*, are as undoubtedly *acids*, as thoſe which cauſe the *precipitations*, viz. *Spirit* of *Vitriol*, and *Spirit* of *Salt*.

So that the precipitation of bodies depend not upon *acid* or *alcalizate Liquors*, as ſuch ; but upon the *conſanguinity* (if I may ſo ſay) of *bodies* or *ſolvends*, to *liquors* or *ſolvents*, *viz.* whilſt an *acid* having diſſolv'd one *body*, meeting with another *akin* thereto, lets the former *fall*, and from an abſtruce *affinity* of parts, *diſſolves* the latter.

From whence it need not ſeem *heterodox*, (although to the moſt it may, as yet, a *paradox*) to ſay, that *fixt Alcalies* open the bodies of *mineral Sulphurs*, as they are *acido-Sulphurous Salts* ; and that chiefly as they partake

take of the *acidum* of *Fire*, aſſum'd by *calcination*; and that *precipitations* of the ſame *ſolutions* may be perform'd (and that too without the leaſt abſurdity in *Philoſophy*) by other ſupervening *Acids*, as we have even now demonſtrated.

As I obſerv'd all *fixt Alcalies* made out of *Vegetables*, to work upon *Mineral Sulphurs*, on the account of their being *Acido-Sulphurous-Salts*; ſo I could not otherwiſe (whilſt I look'd upon the matter with a very intent eye) judge of *calx vive*; whoſe manner of operation, in opening the bodies of *Brimſtone*, and other *Mineral Sulphurs*, I could not charge to any other then its *Acid*, which it had contracted from the *Fire*, in the very *calcination* of that ſort of Stone, call'd *Lapis calcarius*, (*viz.* Free-ſtone or Lime-ſtone) which that it chiefly partakes of the *Acidum* of *Fire*, and thereby performs not only that, but various other effects, we have already in ſhort demonſtrated, and ſhall further in *Lithologia Phyſica.*

From the premiſſes it will eaſily appear, in *confirmation* of our *former Doctrine*, that all ſolutions of *Mineral Sulphurs* in the bowels of the *Earth*, are made by their *peculiar Acids*; and that other ſolutions made by *Art*, are but from the ſame *principles* under other *diſguiſes*; Therefore that which opens the body of *Sulphur*

phur in theſe *Mineral Marcaſites*, through which this *water* (we treat of) *runs*, muſt of neceſſity be an *Acidum*, which afterwards is precipitated by another *Acid* of the *Alom-bed*, through which at laſt it paſſeth.

As to that *experiment* we gave to *illuſtrate* the cauſe and manner of making that *water*, by opening thoſe *vitriolin Marcaſites* with *quick-lime*, in our *Hydrological Eſſays*, although we there imputed it to the *alcali*; yet now from ſecond and more mature thoughts, grounded upon experiment, as aforeſaid, find it otherwiſe; where we profeſs ſuch an avowed *proſelyteſhip* to truth (ſufficiently amiable and worthy in it ſelf) as upon nearer apprehenſions thereof, grounded upon better *weighed principles*, to decline what we have formerly at greater diſtance in any matter opiniated, and in this particular, have thence reaſon to wave the former, and to aſcribe the ſolution of this great *Phœnomenon* to the latter, *viz.* to the *Acid* in *calx vive*, which, in ſome meaſure, bears an *analogy* with that *Acidum*, nature uſeth by her own *Chymiſtry*, in the *intrails* of the *Earth*, for the ſolutions and extractions of *Sulphurs*.

As to the 5*th* thing propoſed to *diſcourſe* of in this our *method*, *viz.* how this *water* comes not much ſhort, as to its *original principles*, nor is much inferiour in its efficacy, to ſome other *Sulphurous waters*, which are *Hot-Baths*, which is evident(beſides what has already been ſaid) by the ſequel thereof, *viz.* becauſe the manner of uſe of both, in reſpect of what they have been, are now reciprocal; thoſe of *Hot-Baths* being formerly chiefly known for *outward*, and theſe for *inward uſe.* But now of late are found, the former in ſome caſes to be ſucceſsful for inward uſe; the latter by *obſervation*, are now eminently remarkable for *outward application* : ſo that the manner of uſe of them *per ſe* conſidered, is inverted, and in a mutual reſpect, is reciprocal.

As to the *virtues* of thoſe *Hot-Baths* (which are lately found remarkable for inward as well as outward uſe) I mean eſpecially thoſe of our *own Country*, the Reader may conſult Dr. *Jorden* his *diſcourſe* of *Natural Baths*, and of late the *Phyſicians*, who have and yet do attend thoſe *waters.*

As to the *virtues* of this *Sulphur-water* (our preſent Theme) as to the uſe thereof as an inward *Medicine*, the Reader may conſult Dr. *French* his Book, and the patient the *Phyſicians* there. It remains now to ſpeak of it in *relation* to outward uſe, as a *Bath*, and this leads me to the next conſiderable, *viz.*

6. That *artificial heating* of the *water*, bears ſome *analogy* to the *inbred heat* of thoſe other *Baths*, as they come *hot* out of the *Earth.*

To the illuſtrating of which we are to conſider *Sulphur* or *Brimſtone* (according to our former Doctrine, that it may become *ſolvable* in *water*, is either to be *comminuted* and *volatiz'd* by the native or ſuperinduc'd *Acids*, and that by a brisk *Fermentation* from the mutual *colliſions* of the two *principles*, whence the heat of *natural Baths*, as aforeſaid, or elſe the *Sulphur*, by ſleighter *touches*, and ſlenderer *vibrations* from congenial *Acids*, becomes ſolvable in a *preterlabent water*, whoſe *heat* therefore (if any) in the ſource of *Fermentation*, is but gentle: yet by that ſleight ſolution of *Sulphur*, it becomes capable of precipitation by another *Acid*, (viz. of *Alom*) as happens in this *water* we treat of: That a body of *Brimſtone* is precipitated is evident from Dr. *Neals obſervation*, concerning a cruſt of *Brimſtone* which he found under the *Stones* of the *Old-Well* at the removing them, through whoſe crevices the *water ſprang*: and that the *Acidity* by which the precipitation is made, is from the *Alom*, doth as clearly appear from the *Aluminous black Stones*, found in the further digging for a better *Spring*. Now what remains in the water after the foreſaid *precipitation*, is no other then the *apporrhea*, or ſubtile *affluvium* of *Sulphur*, which being diſperſed through the whole body of the *water*, is always upon the wing, flying off continually.

This *effluvium* of *Sulphur* complicated with *Salt* in the body of the *water*, although it be very *volatile*, (as I ſaid) yet that it may the better *permeate* our bodies, in order to the performing thoſe expected helps, its neceſſary (as to outward uſe) that the *waters* ſhould be *heated*, by which the *volatile parts* are put into a more *vigorous motion*, and made capable of *penetrating* our *juices* the better: For although *in frigido*, the Sulphurous parts are by a volatility continually winding off, yet by *heating*, its put into a more lively *action*, and made more readily *Fermentable* with the humours of our bodies.

Now that the *Sulphur* in this *water* conſiſts of tenuous parts, and very *volatile*, is evident (beſides what already has been ſaid) by this following *obſervation*, viz. that during the time I *Bath'd* therein, and afterwards went to Bed, having laid my *Silver-ſtudded Watch* upon the Table, thereby to obſerve the time of *Bathing* and *Sweating*, I found the *ſteam* of the *heated water* had guilded it at ſuch a diſtance; and is ſo *conſpicuous*, as to change the colour, (as I have obſerv'd) of the *Braſs-Candleſticks* which ſtood in the next room to the *Bath*. Yea, although this be very *volatile*, yet that it doth not ſuddenly take *wing*, is hence evident, becauſe after three hours time, that the *water* had been heated, when I got up, I dipt a *Six-*

pence therein, which it ſtill guilded very readily.

7. As to the *artificial* reſemblance of *Sulphur Baths* by imitation of *Nature:* Firſt as to *Hot-Baths*, that indeed we fall ſhort in, becauſe its the *work* of *Nature* in the great *Fermentation* of *Mineral juices*, in order to the production of *Mineral concretes:* And ſeeing *Art* doth of neceſſity always *petere principia* from *Nature*, and that thoſe *principles* are *ſeminal*, therefore not to be imitated by *Art*; But inaſmuch as all *Fermentation* amongſt *Minerals*, (as we have formerly ſhew'd) conſiſts in the *inward conflicts* of *Mineral Acids* and *Sulphurs*, and that according to the different aſſaults of the ſaid *Acids*, upon varieties of *Sulphurs*, depend the *ſpecification* or formal difference of *Mineral Waters*; ſo in particular this *Water* being chiefly compos'd of a *Sulphur*, wrought upon by an *Acid*, and afterwards precipitated by another; the reſemblance by *Art* muſt be from the ſame ſort of *principles*, grounded upon the natural: Thus what an *Acid*, (native or ſuperinduc'd) performs upon *Mineral Sulphur*, in order to the making that *Mineral Solution*, required for the *natural compoſure* of this *Water*; The ſame will the *Acidum* of *calx vive*, or of *fixt Alcalies* do *ſuo modo* to *Common Brimſtone*, or other *Mineral Sulphurous Concretions*, as aforeſaid.

And laſtly, As to the virtues hereof: This *Water* being gradually *heated* (as is ſaid) becomes a *Bath*, whoſe *Sulphur* hereby firſt *penetrates* the better into our *Fermental juices*, exciting them, if *languid* through *Hydropick Acids*, or ſpurious, through *Scorbutick Acids*, in the one by helping (with other concurring Medicaments) to remove obſtructions from *coagulated Acids*; in the other, by precipitating, altering and ſweetening *Scorbutick Acids*, the cauſe of pains and particular tumours.

2. Hereby it the better reacheth to dint that *Fermental Acor* of the *Gout*, impreſs'd upon the *Synovia* of the *Joints*, ſo eaſily communicable to the *adjacent Nerves*; hence is the reaſon why its found ſo effectual for the *Scurvey*, *Gout*, &c. *viz.* becauſe theſe forenamed Diſeaſes are chiefly determined and ſpecificated by *Acids*, coagulated upon different humours and parts: For its the Eſſential efficacy (if I may ſo ſay) of a *ſubtiliz'd Sulphur* to dint *Acids*, and thereby to reſolve ſuch as are coagulated; ſo that to me the *diſcuſſion* of all *tumours*, whether *Scorbutick* or others, depend upon the *reſolving* thoſe coagulated *Acids*, the intimate and real efficients thereof; No ſooner doth a Spurious predominant *Acid* coagulate any portion of the *blood*, or other *juice* in any part of the body, but preſently

an obſtruction of thoſe parts happen, more or leſs, according to the intenſe or remiſs degree of the prevalent *Acid*, which as it falls out in Veſſels or Bowels reputed more or leſs noble, *viz.* intenſely or remiſsly concerned in the *fabrick* and *circulation* of *vital juices*, and *animal Spirits*, ſo it becomes the patron of different ſorts of Diſeaſes; ſome whereof eaſily bending to more facile *methods* of *Cure*; others more ſtubborn (of which are the laſt mentioned) not yielding but to more volatile, ſubtiliz'd, and penetrative *Sulphurs*, ſuch as are in this and other *Sulphurous Baths.*

By which (I mean our *Sulphur-Bath*) *Scorbutick* and *Podagrick* Patients have received conſiderable relief: for which cauſe, many perſons, finding thereby ſo much alleviation of the otherwiſe grievous Symptoms, and ſuch a mittigation of the ſeverity of future fits of the *Gout*, (I mean as to what they might have expected, without ſuch a previous help) do voluntarily make their *annual returns* to the *Bath*: of which I could give ſeveral inſtances, but that it doth not ſuit my preſent deſign.

3. By the uſe of this *Bath*, the blood and humours are *purified*, whence it becomes proper for *Blotches*, *Scabs*, *Itches*, *Elephantiaſis*, or *Baſtard Leproſie*, and other *Scorbutick impurities* of the *Blood*; For it procures moſt excellent *Sweats*, whereby the other impure

Acids, (which are precipitated or caſt off from the *Blood* in its *circulation*, and topically *fixed* upon this or the other *external part*;) are looſened, diſſolv'd, or mortifi'd; which deprav'd *Acids* lodge in the habit of the body, having their very *Roots fixed* in the ultimate digeſtion, vitiating the *Blood* and *Latex*, ſent thither for the ordinary nutriment of the body, in the common circulation thereof; yea, they are ſometimes ſo *fixed* upon their own *Roots*, as to tranſmute the otherwiſe *alimentary juice*, by their *Ferments*, into thoſe *external impurities*: which they do as really as a *Crab-tree-ſcions*, or *Bud*, ingraffed into a good *Apple-ſtock*, doth (from its own *ſeminal Ferment*) turn the *juice* of the *Stock*, into the *nature* and *property* of a *Crab*: So that in ſuch *external vitiating* of the *humours*, which are onely skin deep, the applications in order to *Cure* or *Abſtorſion*, muſt be ſuch as can mortifie, diſſolve, alter or correct the foreſaid *externally ſcituated Acids*, which may be, and is, moſt aptly perform'd by this *Sulphur-Bath*.

So that in many the like caſes, where thoſe *Acids* are moſt *pertinacious*, and the *Maladies* thence have taken *deepeſt root*, viz. in the *Elephantaſis*, *Pſora*, *Leproſie*, &c. the moſt common and uſual *Purges* and *Diaphoreticks*, are altogether *inſignificant*, becauſe they reach not thoſe deeply impreſs'd *Acids*, nor correct thoſe *ſpurious Ferments*, ſeated, yea rooted in the *habit* of the *body*; which ſuch *ſubtiliz'd Sulphurs*, as are in this *Bath* skilfully applyed (with other aſſiſting Medicines) are apt chiefly to perform.

Amongſt which *external impurities*, the *Lues Venerea* (being made by carnal contract) may not improperly be reckoned; which conſiſts in a peculiar ſort (in its kind) of a contagious *Fermental Acid*, thence communicable to the *juices* of the *body*, eſpecially where the *contagious Ferment*, by the firſt contract, entered; which by its *corroding acor*, as a cauſtick, fretting and inflaming thoſe *tender parts*, or *coagulating* the *juices* of ſome particular parts (brought thither by an afflux of humours) into *venereal tumours*, whoſe reſtleſs *Ferments* yet lodge in their Bellies, or inwards, in both become the *Authors* of *Nocturnal pains*, *polutions*, &c. to the dinting of which ſpurious *Fermental acor*, (the cauſe of the aforeſaid dolours) the juſt mulct of that Sin muſt be chiefly aim'd at, in the curing thereof: which beſides other *Diaphoreticks*, may very well be perform'd by the help of this *Bath*: And that too, becauſe *Sulphurs*, (eſpecially ſuch as are *prepared* and *volatiz'd* by the *admirable Chymiſtry* of *Nature* in the body or bowels of the Earth) do *ſweeten* and *mortifie* all ſuch ſort of *Acids*: For which purpoſe, in order to the Cure thereof,not only *Bathing*, (and ſome other aſſiſting *Diaphoreticks*) but alſo the *drinking* the ſame *water* is requiſite.

4. By the uſe of this *Bath*, the *nervous maladies* are alſo much helped, of which ſort are *Cramps*, *Convulſions*, *Palſies*, *Apoplexies*, being cauſed from the various ſeiſures upon theſe *juices*, alſo from the *contorſions* and *diſablements* of the Veſſels or *Conduit-pipes*, (the *Nerves*) thoſe *juices* are circulated, or at leaſt carryed in, being the *Organs* wherein the *animal Spirits* move in order to ſenſe, motion, and other *vital functions*,proper thereto,whoſe tone are altered, contorted, contracted, or relax'd by ſeveral ſorts of ſupervening *Acids*, ſent up in *flatulent ſteams*, reſulting from ſome ſpurious ſubordinate *Fermentation*, whoſe *Acids* being ſtrong, have prevail'd, and by a ſort of *ſublimation* are at length *fixt* upon thoſe *animal Cords*, cauſing obſtructions, contractions, relaxations, *&c.* (according to the *morbid Acids*) the cauſes of Diſeaſes relating to the *genus nervoſum.*

Now as *Acids* are the cauſe why *Nerves* undergo thoſe various *alterations* in their *tone* or *texture*, by contractions, relaxations, *&c.* and in their *juices* by coagulations, and thence obſtructions, or other debilitudes, whereby the volatile nimble *animal Spirits* become *interrupted* in their *motion*, being block'd up by ſuch ſort of *coagulations* : ſo in order to the Cure of theſe Diſeaſes, ſuch *Medicaments* and *Methods* are to be inquired into, as may *dint*, *alter*, and *dulcifie* ſuch kinds of *Acids*, and thence may looſen the *contracted*, ſmooth and make even the *contorted*, may ſtrengthen the *relaxed Cords*, yea and may every way anſwer the *indications* of the deprav'd *tones* of thoſe *animal pendula's* or *vital ſtrings*, whereby the impriſoned *Spirits*, (the immediate product of *vital Fermentation* may again be ſet at liberty, and all the *animal functions* be reſtored to their *priſtine ſtate* : of which ſort are our *Sulphur-Bath*, which by correcting the *Acids*, ſupple and ſoften the *contracted*, ſtrengthen and bind up the *weak*, and very much repair, in the *maine*, the *deprav'd tone* of the *genus Nervoſum*.

Laſtly, By the uſe of this *Bath*, the contraction of the tendons, and muſculous parts, I mean *ſtiffneſs* of the *Limbs*, *Joynts*, &c. (where the contraction is not too fixed) are often remedied: For theſe outward maladies being cauſed through ſome rejected *Acids*, which wanting a due *Fermentative motion* to give them *wing* by *perſpiration*, are *coagulated* or *hardened* (partly by the aſſiſtance of the Air) in the external parts; but by the *Sulphur* in the *Bath*, the pores being opened, and they diſſolv'd, and put into *motion*,

are

French Grammar, by the Doctors of the *Sorbon* at *Paris*, for Reformation of the French Tongue, In French and Engliſh, 8°

Secrets Reveal'd, or an open Entrance to the Shut-Pallace of the King, containing the chief Treaſury of Chymiſtry, 8°

The Philoſophical Epitaph, *&c.* together with a Catalogue of Chymical Books in three Parts, 8°

Dr. *Simpſons* Philoſophical Diſcourſe of Fermentation; with a Diſcourſe of the *Sulphur-Bath* at *Knarsbrough* in *York-ſhire*, 8°

A *Caveat* for the *Proteſtant Clergy*, or a true account of the Sufferings of the *Engliſh Clergy* upon the Reſtitution of Popery in the days of *Queen Mary*, 8°

Paracelſus his *Archidoxes*, diſcovering the way of making *Quinteſſences*, *Arcanums*, *Magiſteries*, *Elixirs*, &c. 8°

——His *Aurora* and Treaſure of the Philoſophers, together with the Water-ſtone of of the Wiſe men, 8°

The Fame and Confeſſion of the Fraternity of the *Roſie-Croſs*, 8°

Where likewiſe moſt ſorts of Chymical or Philoſophical Books, may be had, whether in Engliſh or Latin.

FINIS.

A[illegible]